

**NASA**

**SECTION 21**



**Subject:** FW: STS-107 Debris Analysis Team Meeting  
**Date:** Wednesday, January 29, 2003 2:50 PM  
**From:** CAMPBELL, CARLISLE C., JR (JSC-ES2) (NASA)  
<carlisle.c.campbell@nasa.gov>  
**To:** "LAW, HOWARD G. (JSC-EG) (NASA)" <howard.g.law@nasa.gov>,  
"jhoman@mail.arc.nasa.gov" <jhoman@mail.arc.nasa.gov>

-----Original Message-----

**From:** ROCHA, ALAN R. (RODNEY) (JSC-ES2) (NASA)  
**Sent:** Thursday, January 23, 2003 7:59 AM  
**To:** SHACK, PAUL E. (JSC-EA42) (NASA); SERIALE-GRUSH, JOYCE M. (JSC-EA) (NASA); KRAMER, JULIE A. (JSC-EA4) (NASA); CAMPBELL, CARLISLE C., JR (JSC-ES2) (NASA); MILLER, GLENN J. (JSC-EA) (NASA)  
**Subject:** FW: STS-107 Debris Analysis Team Meeting

FYI.

Rodney Rocha  
Structural Engineering Division (ES-SED)

- \* ES Div. Chief Engineer (Space Shuttle DCE)
- \* Chair, Space Shuttle Loads & Dynamics Panel

Mail Code ES2 Phone 281-483-8889

-----Original Message-----

**From:** Madera, Pamela L  
[mailto:pam.l.madera@usahq.unitedspacealliance.com]  
**Sent:** Wednesday, January 22, 2003 11:22 AM  
**To:** CURRY, DONALD M. (JSC-ES3) (NASA); ROCHA, ALAN R. (RODNEY) (JSC-ES2) (NASA); LEVY, VINCENT M. (JSC-EG) (NASA); KOWAL, T. J. (JOHN) (JSC-ES3) (NASA); DERRY, STEPHEN M. (STEVE) (JSC-EG3) (NASA); Nagle, Scott M; Carlos Ortiz (E-mail); GOMEZ, REYNALDO J. (RAY) (JSC-EG3) (NASA); DISLER, JONATHAN M. (JON) (JSC-SX) (LM); Jacobs, William A  
**Cc:** 'Scott Christensen V (E-mail)'; 'Norman Ignacio (Nacho) (E-mail)'; CHAO, DENNIS; Stoner-1, Michael D; 'Carlos Ortiz (E-mail)'; 'Michael J Dunham (E-mail)'; Sebesta, Stephen P; CORONADO, DIANA; 'Craig Madden' (E-mail); Bell, Dan R.; Gordon, Michael P.; 'Paul A Parker (E-mail)'; ISHMAEL, MOHAMED I. (GEORGE) (JSC-NC) (SAIC); ALEXANDER, ED  
**Subject:** STS-107 Debris Analysis Team Meeting

Rodney Rocha has conference room 221 in JSC Building 13 available for today's 1:00 PM telecon. Located on second floor. The dial in number is the same as below. I propose the following agenda:

Review of transport analysis (Carlos Ortiz - charts attached)  
Discussion of appropriate Particle Size (Ortiz, Disler, all)  
Review of Flight Design Plans for Assessing Options (Bill Jacobs)  
Status of Impact Damage Assessment (P. Parker)  
Status of Thermal Analysis (Norm Ignacio/Dennis Chao)  
Approach for stress assessment (Dunham)  
Discussion on Need/Rationale for Mandatory Viewing of damage site (All)

<<STS-107 Preliminary Debris Assessment - rev2.ppt>>

Pam Madera  
Vehicle and Systems Analysis Subsystem Area Manager  
Phone: 281-282-4453

-----Original Message-----

From: Madera, Pamela L  
Sent: Monday, January 20, 2003 5:47 PM  
To: CURRY, DONALD M; RÓCHA, ALAN RODNEY; LEVY, VINCENT M; KOWAL, T  
JOHN; DERRY, STEPHEN M  
Cc: 'Scott Christensen V (E-mail)'; 'Norman Ignacio (Nacho)  
(E-mail)'; CHAO, DENNIS; Stoner-1, Michael D; 'Carlos Ortiz (E-mail)';  
'Michael J Dunham (E-mail)'; Sebesta, Stephen P; CORONADO, DIANA;  
'Craig Madden' (E-mail); Bell, Dan R.; Gordon, Michael P.; Paul A  
Parker (E-mail)

Subject: STS-107 Debris Analysis Team Plans

The Boeing/USA team would like to meet with you Tuesday at 2:00  
on meet-me-line number to discuss analysis  
plans for assessing the STS-107 Debris Impact.

Pam Madera  
Vehicle and Systems Analysis Subsystem Area Manager  
Phone: 281-282-4453

## Michele Lewis

**From:** LEVY, VINCENT M. (JSC-EG) (NASA)  
**Sent:** Thursday, December 12, 2002 12:12 PM  
**To:** HAMMERSCHMIDT, MARK M. (JSC-EG4) (NASA); RUPPERT, JOHN P. (JSC-EG) (NASA); THIBODEAU, JOSEPH R. (JOE) (JSC-EG) (NASA); DERRY, STEPHEN M. (STEVE) (JSC-EG3) (NASA)  
**Cc:** KANIPE, DAVID B. (DAVE) (JSC-EG) (NASA)  
**Subject:** FW: STS-107 Quick Look Summary - "Final"

**Follow Up Flag:** Follow up  
**Due By:** Thursday, December 12, 2002 1:00 PM  
**Flag Status:** Flagged

FYI-Meeting Monday with Benz.

*Vincent M. Levy*  
EG/Aeroscience & Flight Mechanics  
Shuttle Division Chief Engineer  
281-483-0874 (w)

281-483-1245 (fax)

-----Original Message-----

**From:** SERIALE-GRUSH, JOYCE M. (JSC-EA) (NASA)  
**Sent:** Wednesday, December 11, 2002 6:33 PM  
**To:** DINSMORE, CRAIG E. (JSC-EC5) (NASA); CHHIPWADIA, KETAN S. (K.C.) (JSC-EC) (NASA); BRANCH, GLEN (JSC-EB) (NASA); STEPHENSON, DAVID A. (JSC-EB) (NASA); WITTSCHEIN, BARRY C. (JSC-EA4) (NASA); BENAL, LEO C. (JSC-EA) (NASA); RODRIGUEZ, HECTOR I. (JSC-EA4) (NASA); SAIZ, JOHN R. (JSC-EB) (NASA); WETTERSTROEM, ALBERT (JSC-EB) (NASA); ALBRIGHT, JOHN D. (JSC-EP4) (NASA); DUNN, KEVIN W. (JSC-EV) (NASA); GRUSH, GENE R. (JSC-EP111) (NASA); JACOBS, JEREMY B. (JSC-ES4) (NASA); KAUPP, HENRY J. (JSC-ER3) (NASA); KRAMER, JULIE A. (JSC-EA4) (NASA); LEVY, VINCENT M. (JSC-EG) (NASA); METCALF, JORDAN L. (JSC-EC6) (NASA); PHAM, CHAU H. (JSC-EC6) (NASA); PREVETT, DONALD E. (DON) (JSC-EP) (NASA); PRUETT, WILLIAM R. (JSC-EV) (NASA); ROCHA, ALAN R. (RODNEY) (JSC-ES2) (NASA); ROMERO, DENISE M. (JSC-EV) (NASA); SHACK, PAUL E. (JSC-EA42) (NASA); THIBODEAU, JOSEPH R. (JOE) (JSC-EG) (NASA); WAGNER, HOWARD A., PHD (JSC-EP) (NASA); WILSON, SUE U. (JSC-EA) (NASA); SAUNDERS, PENNY E. (JSC-EA2) (NASA); PRUETT, WILLIAM R. (JSC-EV) (NASA); WALKER, STEPHANIE (JSC-EC) (NASA); DONAHOE, STANLEY R. (JSC-EA) (NASA); BRANCH, GLEN (JSC-EB) (NASA); SCHWARZ, ROGER G. (JSC-EC) (NASA); BLACKBURN, GREGORY C. (GREG) (JSC-EV) (NASA); LEBLANC, JAMES C. (JSC-EB) (NASA); RODRIGUEZ, HECTOR I. (JSC-EA4) (NASA)  
**Cc:** SHACK, PAUL E. (JSC-EA42) (NASA); WILSON, SUE U. (JSC-EA) (NASA); HAMILTON, DAVID A. (DAVE) (JSC-EA) (NASA)  
**Subject:** STS-107 Quick Look Summary - "Final"

DCEs and Task Owners:

**PLEASE LIMIT DISTRIBUTION OF THIS EMAIL DUE TO STS-107 LAUNCH INFO ENCLOSED**

Here is the "finalized" STS-107 Quick Look Summary package. Thanks for all of your inputs. I did not receive an input from EC-ECLS or EV-Software, so I "wrote" something up myself (i.e., pulled words from previous presentations). Also, EB did not respond, so Penny Saunders/EA2 helped me out there (thanks Penny), plus I got a verbal from John Saiz. **If you three groups could review the package to make sure I captured your topics correctly, I'd appreciate it.** As stated, we go to Frank Benz and Lauri Hansen on Monday, Dec 16th at 9:15 AM and I'm scheduled to be off on Thursday and potentially Friday (sigh). I'll try and get in early on Monday to correct anything you folks see as being in error. Also, I will check my email from home.

**Jordan Metcalf/EC** - please fill in the "X" on page 9 (or remove the sentence totally - I was working from my memory here).

**Glen Branch/EB** - if you wish to add anything for your hardware, please let me know (I'm assuming at this time you have no inputs).

**Hector Rodriguez/EA2** - please let me know if you want me to slip in your normal GFE summary for the meeting on the 16th. If so, just email it to me before Monday.

**Subject:** Look at that Spaceship: STS-107 Sightings  
**Date:** Monday, January 27, 2003 4:12 PM  
**From:** NASA Science News <snclist@snclist.msfc.nasa.gov>  
**Reply-To:** "NASA Science News" <snclist@snclist.msfc.nasa.gov>  
**To:** NASA Science News <snclist@snclist.msfc.nasa.gov>

NASA Science News for January 27, 2003

The space shuttle Columbia (STS-107), which is on a 16-day mission dedicated to scientific research, will make a lovely series of morning passes over the United States this week.

FULL STORY at

[http://science.nasa.gov/headlines/y2003/27jan\\_dejavu.htm?list776292](http://science.nasa.gov/headlines/y2003/27jan_dejavu.htm?list776292)

You are currently subscribed to snclist as: howard.g.law1@jsc.nasa.gov

This is a free service.

To UNSUBSCRIBE, or CHANGE your address on this service, go to <http://science.nasa.gov/news/subscribe.asp?e=howard.g.law1@jsc.nasa.gov> or send a blank email to [leave-snclist-776292M@snclist.msfc.nasa.gov](mailto:leave-snclist-776292M@snclist.msfc.nasa.gov).

NASA is looking for Teachers to be Astronauts! Are you the right person, or do you know someone who might be? Check out <http://edspace.nasa.gov/?science.nasa.gov> for information.

If you need to get in touch with us directly, please go to <http://science.nasa.gov/comments>

Home page: <http://science.nasa.gov>

**Subject:** FW: Main Gear Breach Concerns

**Date:** Monday, February 10, 2003 11:48 AM

**From:** CAMPBELL, CARLISLE C., JR (JSC-ES2) (NASA)

<carlisle.c.campbell@nasa.gov>

**To:** "LAW, HOWARD G. (JSC-EG) (NASA)" <howard.g.law@nasa.gov>

-----Original Message-----

From: Robert H. Daugherty [mailto:r.h.daugherty@larc.nasa.gov]

Sent: Thursday, January 30, 2003 5:23 PM

To: LECHNER, DAVID F. (JSC-DF52) (USA)

Cc: M.J.SHUART@larc.nasa.gov; H.M.ADELMAN@larc.nasa.gov; CAMPBELL, CARLISLE C., JR (JSC-ES2) (NASA)

Subject: Main Gear Breach Concerns

Hi David,

I talked to Carlisle a bit ago and he let me know you guys at MOD were getting into the loop on the tile damage issue. I'm writing this email not

really in an official capacity but since we've worked together so many times I feel like I can say pretty much anything to you. And before I begin I would offer that I am admittedly erring way on the side of absolute

worst-case scenarios and I don't really believe things are as bad as I'm

getting ready to make them out. But I certainly believe that to not be ready for a gut-wrenching decision after seeing instrumentation in the wheel well not be there after entry is irresponsible. One of my personal

theories is that you should seriously consider the possibility of the gear

not deploying at all if there is a substantial breach of the wheel well. The reason might be that as the temps increase, the wheel (aluminum)

will lose material properties as it heats up and the tire pressure will increase. At some point the wheel could fail and send debris everywhere. While it is true there are thermal fuses in the wheel, if the

rate of heating is high enough, since the tire is such a good insulator,

the wheel may degrade in strength enough to let go far below the 1100 psi

or so that the tire normally bursts at. It seems to me that with that much

carnage in the wheel well, something could get screwed up enough to prevent

deployment and then you are in a world of hurt. The following are scenarios that might be possible...and since there are so many of them, these are offered just to make sure that some things don't slip thru the

cracks...I suspect many or all of these have been gone over by you guys already:

1. People talk about landing with two flat tires...I did too until this

came up. If both tires blew up in the wheel well (not talking thermal fuse

and venting but explosive decomp due to tire and/or wheel failure) the overpressure in the wheel well will be in the 40 + psi range. The

resulting loads on the gear door ( a quarter million lbs) would almost certainly blow the door off the hinges or at least send it out into the slip stream...catastrophic. Even if you could survive the heating,

would the gear now deploy? And/or also, could you even reach the runway with this

kind of drag?

2. The explosive bungies...what might be the possibility of these firing due to excessive heating? If they fired, would they send the gear door and/or the gear into the slipstream?
3. What might excessive heating do to all kinds of other hardware in the wheel well...the hydraulic fluid, uplocks, etc? Are there vulnerable hardware items that might prevent deployment?
4. If the gear didn't deploy ( and you would have to consider this before making the commitment to gear deploy on final) what would happen control-wise if the other gear is down and one is up? (I think Howard Law and his community will tell you you're finished)
5. Do you belly land? Without any other planning you will have already

committed to KSC. And what will happen during derotation in a gear up landing (trying to stay away from an asymmetric gear situation for example) since you will be hitting the aft end body flap and wings and pitching down extremely fast a la the old X-15 landings? My guess is you would have an extremely large vertical decel situation up in the nose for the crew. While directional control would be afforded in some part by the drag chute...do you want to count on that to keep you out of the moat?

6. If a belly landing is unacceptable, ditching/bailout might be next on the list. Not a good day.
7. Assuming you can get to the runway with the gear deployed but with two flat tires, can the commander control the vehicle both in pitch and lateral directions? One concern is excessive drag (0.2 g's) during TD throughout the entire saddle region making the derotation uncontrollable due to saturated elevons...resulting in nose gear failure? The addition of crosswinds would make lateral control a tough thing too. Simulating this, because it is so ridiculously easy to do (sims going on this very minute at AMES with load-persistence) seems like a real no-brainer.

Admittedly this is over the top in many ways but this is a pretty bad time to get surprised and have to make decisions in the last 20 minutes. You

can count on us to provide any support you think you need.  
Best Regards,  
Bob

## Michele Lewis

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**From:** LEVY, VINCENT M. (JSC-EG) (NASA)  
**Sent:** Wednesday, December 11, 2002 11:51 AM  
**To:** ROCHA, ALAN R. (RODNEY) (JSC-ES2) (NASA); MILLER, GLENN J. (JSC-EA) (NASA); HANSEN, LAURI N. (JSC-EA1) (NASA); BENZ, FRANK J. (JSC-EA) (NASA); SHACK, PAUL E. (JSC-EA42) (NASA); SERIALE-GRUSH, JOYCE M. (JSC-EA) (NASA)  
**Cc:** GRUSH, GENE R. (JSC-EP111) (NASA); DERRY, STEPHEN M. (STEVE) (JSC-EG3) (NASA); KOWAL, T. J. (JOHN) (JSC-ES3) (NASA); ROGERS, JOSEPH E. (JOE) (JSC-ES2) (NASA); GALBREATH, GREGORY F. (GREG) (JSC-ES2) (NASA); KRAMER, JULIE A. (JSC-EA4) (NASA); RUPPERT, JOHN P. (JSC-EG) (NASA); HAMMERSCHMIDT, MARK M. (JSC-EG4) (NASA); SERIALE-GRUSH, JOYCE M. (JSC-EA) (NASA); SHACK, PAUL E. (JSC-EA42) (NASA)  
**Subject:** RE: Jammed Actuator

Rodney- as we left the meeting with Ms. Hansen and Mr. Benz EG took an action to evaluate Entry Flight Control and Aerothermal impacts due to this Body Flap corrosion issue. Mark Hammerschmidt(Entry Expert) and Steve Derry (Aerothermo Expert) are working this activity. Conclusions from Flight Control should come from EG not EP. EA4 needs to provide better integration among disciplines. As soon as Mr. Hammerschmidt completes his sim work we will share results with the community.

*Vincent M. Levy*

EG/Aeroscience & Flight Mechanics  
Shuttle Division Chief Engineer  
281-483-0874 (w)

281-483-1245 (fax)

-----Original Message-----

**From:** ROCHA, ALAN R. (RODNEY) (JSC-ES2) (NASA)  
**Sent:** Wednesday, December 11, 2002 9:40 AM  
**To:** MILLER, GLENN J. (JSC-EA) (NASA)  
**Cc:** GRUSH, GENE R. (JSC-EP111) (NASA); LEVY, VINCENT M. (JSC-EG) (NASA); DERRY, STEPHEN M. (STEVE) (JSC-EG3) (NASA); KOWAL, T. J. (JOHN) (JSC-ES3) (NASA); ROGERS, JOSEPH E. (JOE) (JSC-ES2) (NASA); GALBREATH, GREGORY F. (GREG) (JSC-ES2) (NASA); KRAMER, JULIE A. (JSC-EA4) (NASA); RUPPERT, JOHN P. (JSC-EG) (NASA); HAMMERSCHMIDT, MARK M. (JSC-EG4) (NASA); SERIALE-GRUSH, JOYCE M. (JSC-EA) (NASA); SHACK, PAUL E. (JSC-EA42) (NASA)  
**Subject:** RE: Jammed Actuator

I did not agree with Gene Grush's statement to EA this morning. The EG story for aero-thermal heating increases (to BF and elevons, which are being worked more in jam scenario) and impacts to flight control, constrained pilot techniques, and a new tail scrape attitude at main gear touch-down) have not been reviewed and assessed. Depending on the jammed BF position (zero position or else some commanded down non-zero position), the elevons would have to do more duty and thus experience more heating, more heating to the elevon seals (same as BF seals), more heating to the underlying structure, elevons counteracting the down-stuck BF or else do all the trim work of a zero-stuck BF.

Note to EG folks: When can we have a review on these subjects?

**Rodney Rocha**

Structural Engineering Division (ES-SED)

- ES Div. Chief Engineer (Space Shuttle DCE)
- Chair, Space Shuttle Loads & Dynamics Panel

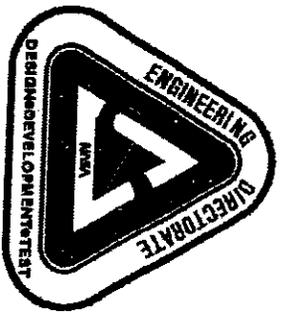
Mail Code ES2 Phone 281-483-8889



STS-107 Benz  
Look summa

Thanks,  
Joyce

**Joyce M. Seriale-Grush**  
*Shuttle Engineering Office/EA42*  
**Phone: 281-483-4542**  
**Fax: 281-483-2965**



Johnson Space Center - Houston, Texas

Rev 2

**Engineering Directorate  
STS-107 Quick Look  
Summary**

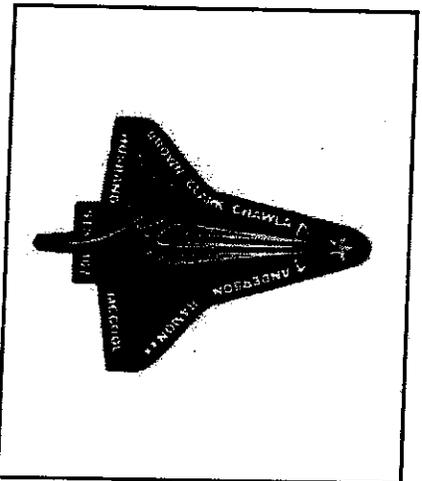
**Shuttle Engineering Office**

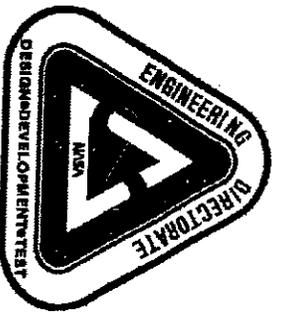
Shack/S-Grush

Dec 16, 2002

**STS-107 (OV-102)**

**-QUICK LOOK SUMMARY-**  
**Engineering Directorate**





## Engineering Directorate STS-107 Quick Look Summary

Shuttle Engineering Office

Shack/S-Grush

Dec 16, 2002

## STS-107 MISSION HIGHLIGHTS

(provided by Boeing/USA Integration)

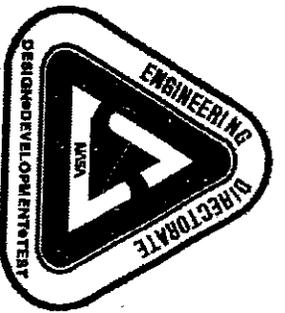
### First Flight of the following:

- **SPACEHAB as the SPACEHAB Research Double Module (SHRDM)**
- **Fast Reaction Experiments Enabling Science, Technology, Applications and Research (FREESTAR) Crossbay Hitchhiker Platform**
  - Mediterranean Israeli Dust Experiment (MEIDEX)
  - Low Power Transceiver (LPT)
- **2 Advanced Master Events Controllers (AMECs)**
- **OMS Assist of 7000 lbs. (previous maximum of 4,000 lbs.)**

### Second Flight of the following:

- **Performance Enhancements (PE) Flight with a Light Weight Tank (LWT)**
  - LWT ET-93 Manifested on STS-107
  - Last Flight with a Light Weight Tank was STS-99 (February 11, 2000)
  - Only 1 additional LWT remains in inventory

**First Extended Duration Orbiter (EDO) Mission Since STS-90 (April 17, 1998)**



## Engineering Directorate STS-107 Quick Look Summary

Shuttle Engineering Office

Shack/S-Grush

Dec 16, 2002

## STS-107 MISSION OBJECTIVES

(provided by Boeing/USA Integration)

- **Perform Attached Cargo Operations**
  - SPACEHAB Research Double Module (SHRDM)
  - Fast Reaction Experiments Enabling Science, Technology, Applications and Research (FREESTAR)
    - Mediterranean Israeli Dust Experiment (MEIDEX)
    - Shuttle Ozone Limb Sounding Experiment-2 (SOLSE-2)
    - Critical Viscosity of Xenon-2 (CVX-2)
    - Solar Constant Experiment-3 (SOLCON-3)
    - Space Experiment Module (SEM)
    - Low Power Transceiver (LPT)
    - Orbital Acceleration Research Experiment (OARE)
- **Crew Compartment Payloads**
  - Shuttle Ionospheric Modification with Pulsed Local Exhaust Experiment (SIMPLEX)
  - Ram Burn Observation (RAMBO)
- **Perform 2 Development Test Objectives (DTOs)**
- **Perform 3 Detailed Supplementary Objectives (DSOs)**



<h1>Engineering Directorate</h1> <h2>STS-107 Quick Look</h2> <h3>Summary</h3>		<h2>Shuttle Engineering Office</h2>	
		Shack/S-Grush	Dec 16, 2002

## MISSION OVERVIEW

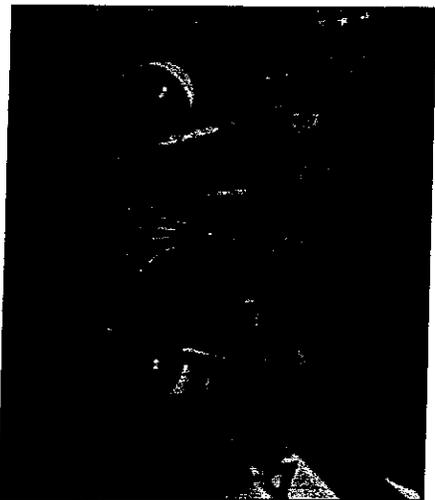
(provided by Boeing/USA Integration)

### VEHICLE AND CONFIGURATION

- OV-102 (Fit 28)
- OI 29 SOFTWARE (Fit 5)
- RMS NOT INSTALLED
- Cryo Tank Sets – 9 (Off Loaded)

### CREW

- 7 MEMBER CREW - Dual Shift
  - CDR – Rick D. Husband (2<sup>nd</sup> fit) Mission Specialist – David M. Brown (1<sup>st</sup> fit)
  - PLT – William "Willie" McCool (1<sup>st</sup> fit) Mission Specialist – Kalpana Chawla (2<sup>nd</sup> fit)
  - Payload CDR – Michael P. Anderson (2<sup>nd</sup> fit) Mission Specialist – Laurel B. Clark (1<sup>st</sup> fit)
  - Payload Specialist – Ilan Ramon (1<sup>st</sup> fit)

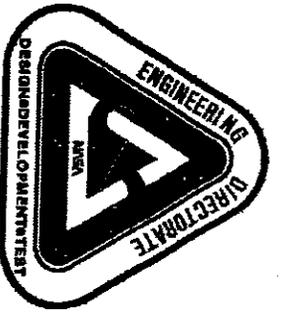


- No scheduled EVA's planned

### MISSION

- 1/16/03 LAUNCH\*, 10:39 AM EST (Thursday), Pad/MLP 39A/1 – Daylight
- 150 minute WINDOW
- 39 DEGREE INCLINATION - Direct Insertion / 150 nm
- Planned Mission Duration: 16 + 0 (ops b/u day) + 2 (contingency/weather avoidance);
- 2/1/03 KSC NOMINAL LANDING\*, 8:49 AM EST (Saturday) – Daylight

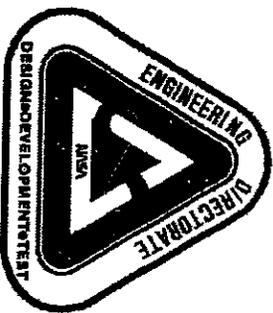
\* Note: Launch/Landing times not to be released to General Public until 24 hrs prior to planned event.



Johnson Space Center - Houston, Texas

<b>Engineering Directorate STS-107 Quick Look Summary</b>		<b>Shuttle Engineering Office</b>	
		Shack/S-Grush	Dec 16, 2002

# **EA STS-107 pre-FRR Topics**



<b>Engineering Directorate</b> <b>STS-107 Quick Look</b> <b>Summary</b>		<b>Shuttle Engineering Office</b>	
		Shack/S-Grush	Dec 16, 2002

• **EA STS-107 pre-FRR Topics Summary:**

• **EA42 - STS-107 Payload Safety Assessment**

- There are 4 STS-107 payloads with 3 being re-flights – No payload safety issues exist (see backup charts).

• **EA2 – STS-107 Shuttle / FCE GFE Upfront Summary**

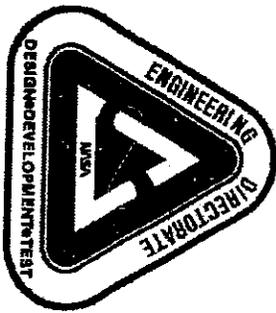
- (still to be provided by H. Rodriguez/EA2)

• **EC – CCE**

• CEE - SEBS: Overhaul waiver

- SEBS units were provided for STS-107 in early CY2002 to support STS-107's original launch date
- Due to multiple launch scrubs, a message was sent out to all hardware providers to review hardware limited life and age-sensitive requirements to determine if hardware requires extraction for refurb, etc; This message was also received by the previous CCE SSM later than expected
- Since previous CCE SSM's transition out of Shuttle CEE, he was still listed as CEE POC for SpaceHab; a delay in message transmission from him to the current SSM ensued (current SSM received the message in mid-September)
- SpaceHab had only a few "hatch open" dates for hardware access
- SEBS (qty two [2]) units for STS-107 came due their 6-year periodic overhaul in JAN 2003 and FEB 2003

continued



<b>Engineering Directorate STS-107 Quick Look Summary</b>		<b>Shuttle Engineering Office</b>	
		Shack/S-Grush	Dec 16, 2002

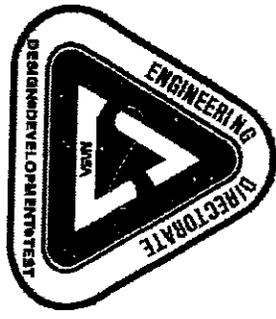
**EA STS-107 pre-FRR Topics Summary (cont'd):**

**EC – CCE (continued)**

- CEE - SEBS: Overhaul waiver (cont'd)
  - Overhaul consists of soft-good replacements (o-rings, diaphragm), re-proof pressure, and re-PIA
  - After technical coordination with ES, M&P, QE, and S&MA, it was agreed that overhaul can be waived for additional six (6) months or one (1) Shuttle mission (whichever is shorter), if SEBS units at KSC can be re-inspected for pressure quantity (this was successfully accomplished and cylinders were verified tight)

**CEE - SEBS: Proof pressure waiver**

- During historical research of the above waiver, it was discovered that all SEBS' units were NOT proof pressure tested (which is required in accordance with the SEBS PRD)
- The predecessor to the previous CEE SSM did have a discussion with ES (G. Ecord). At that time, it was agreed to exempt; however, EC did not correctly process a waiver to document and secure MV's approval
- This waiver is being submitted to remove the previous delinquency



<b>Engineering Directorate</b>		<b>Shuttle Engineering Office</b>	
<b>STS-107 Quick Look</b>			
<b>Summary</b>		Shack/S-Grush	Dec 16, 2002

• **EA STS-107 pre-FRR Topics Summary (continued):**

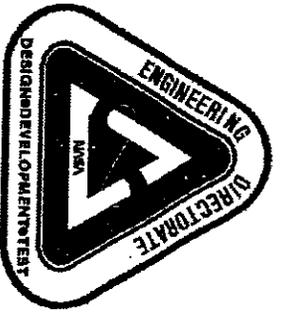
• **EC - EVA**

• EMU Boot Fit

- During EVAs 1 and 2 of STS-113, crewmember Lopez-Alegria complained of cold and numb feet
- Post EVA #1, resizing was performed without EC knowledge or input
- Post EVA #2, resizing/reconfiguring was performed with EC help
- EVA #3 produced no complaints
- Investigation revealed that zero-G growth sizing change was performed improperly during processing
- ISS-6 and STS-107 sizing was checked by EC, no problems expected
- Requirements document will be modified so that zero-G sizing modifications will be performed as intended

• Damaged EMU Bio-Medical Cable

- On-orbit inspection of a bio-med cable in the EMU post EVA 1 of STS-113 revealed a broken outer shield
- Since EB owns the cable, EC owns the EMU and EV owns the radio, XA formed and is leading the investigation team
- No knowledge yet of how the cable was damaged; instead, the team is has focused on determining whether or not an exposed wire from a broken cable could lead to a short and subsequently a fire
- EV has performed electrical testing to determine worst case energy if a "smart" short were to occur
- EC/ES/WSTF are working together to identify if one of the EMU or cable materials could be ignited
- Initial results indicate that the current design does not pose a credible fire risk.
- The delay of the Increment 6 EVA has provided the team more time to evaluate the input from all organizations



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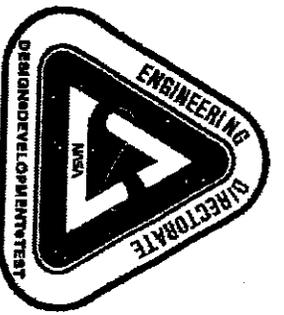
• **EA STS-107 pre-FRRR Topics Summary (continued):**

• **EC – ECLSS**

• STS-113 Prelaunch ECLSS PCS System 2 O2 Leak

- High O2 level detected by mid-body and payload bay hazardous gas detection system (HGDS) during STS-113 pre-launch (130-150 ppm of O2 – s/b approx zero). Troubleshooting isolated leak of approx 550 scim to ECLS secondary Pressure Control System (PCS) system 2 between system supply valve and crew module Xo576 bulkhead -- First launch attempt was aborted.
- Subsequent inspection found flowing leak in the Xo576 bulkhead flex hose near the bulkhead fitting.
  - Hose braid showed signs of "bird caging" deformation. Similar incidents of this type of damage has been seen in the MPS system flexhoses (same vendor/design)
  - Leaking O2 hose was R&R'd – failure analysis indicated presence of fatigue striations across fracture face and no indications of ductile overload
- OV-105 secondary N2 flex-hose was R&R'd due to proximity and configuration similarities to secondary O2 hose. Also, removed primary O2 hoses from OV-103 and OV-104 and auxiliary O2 hose from OV-103. Obtained secondary O2 and N2 hoses previously removed from OV-102, and MPS ¼" helium flex-hose of similar configuration. Failure analysis was performed on all removed hoses.
- Failure analysis findings showed presence of cracks and fatigue striations in some flexhoses due to relatively low frequency reverse bending fatigue
- All flex lines examined which exhibited fatigue cracking had associated damage on the line exterior. Also, all flex-hoses removed due to leakage had evidence of exterior line damage.

continued



<b>Engineering Directorate</b> <b>STS-107 Quick Look</b> <b>Summary</b>		<b>Shuttle Engineering Office</b>	
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• **EA STS-107 pre-FRR Topics Summary (continued):**

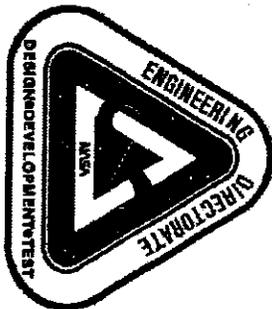
• **EC – ECLSS**

• STS-113 Prelaunch ECLSS PCS System 2 O2 Leak (continued)

- Root cause is unknown – most likely cause of low frequency bending is: ground environment (traffic/handling or roll to VAB or pad) though flight environment could be a contributor (less likely based on evidence of low frequency environment)
- Review of ECLSS flex hose qual records confirms did not adequately qual flex-hoses for this relatively low frequency environment
- OV-102/STS-107 flight rationale: Secondary O2/N2 hoses on OV-102 have low cycle life (replaced X flights ago). Also, the Program has accepted problem as a low flight risk based on (1) PRACA history, (2) low probability of being a flight environment problem, and (3) redundancy.
  - MPS crit 1/1 hoses of similar design were adequately qualified and have sufficient inspection requirements in place.

• STS-113 FES Failure Using Primary B Controller (IFA: STS-113-V-03)

- The FES shut down at 335/23:45 G.m.t. (7/22:55 MET), during a FES water dump on the PRIMARY B controller.
- After attempts to restart on PRI B and then PRI A were unsuccessful, ice formation was suspected and the core flush procedure was performed.
- The core flush was successful and the system operated nominally on the PRI A controller. For the remainder of the flight, FES PRI A was utilized with no further anomalies.
- The KSC troubleshooting is in place and scheduled for Dec. 11, 2002



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• **EA STS-107 pre-FRR Topics Summary (continued):**

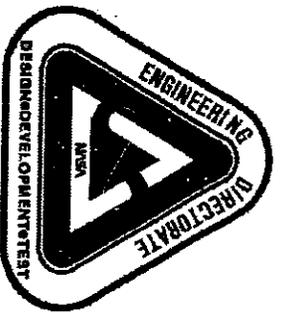
• **EP – Propulsion and Power**

- Rotary Actuator Gear/Housing Corrosion – **OPEN ISSUE / FLIGHT CONSTRAINT**
  - Internal corrosion found inside Body Flap (BF) actuators being repaired at Hamilton Sundstrand (HS)
  - Actuators on OV-102 may have similar condition
  - RSB actuators could have similar concern (similar design / same materials)
  - Hydraulic Actuator PRT is working issue with Stress/Loads/Materials/GNC – weekly statuses to MV planned.
  - Flight rationale will be based on margin's analysis, jamming implications to GNC, and possible removal / inspections of available fleet hardware (e.g., OV-103)
  - Final Resolution: TBD

• OV-103 17" LO2 Feedline BSTRA Ball Cracks – **OPEN ISSUE / FLIGHT CONSTRAINT**

- Boroscope inspections (OMDP reqmt) of OV-103 17 Inch LO2 Feedline BSTRA's revealed a suspect crack in the feedline BSTRA ball nearest the manifold – PR MPS-3-J3-1589.
- BSTRA joints are located in the two upstream SSME 12" feedline joints and all three 17" feedline flex joints – Total per Orbiter = 18. BSTRA's provide internal structural support to the feedlines while allowing the line to articulate under cryo, press, dynamic loading conditions. Each BSTRA consists of 2 hubs, suspended in the flow stream by 3 mounting legs, with a ball located inside the hubs.
  - BSTRA ball material – "Stoody #2" (alloy of Co, Cr, W, Si, C, Fe, and Mo); Rockwell = 62
  - BSTRA ball dimensions – LO2/17" = 2.25"; LO2/12" = 1.75"; LH2/all = 1.25"
- Failure concerns: Potential structural failure of line; binding/inability to articulate line; commonality to 12" feedlines and contamination issues

continued



<b>Engineering Directorate STS-107 Quick Look Summary</b>		<b>Shuttle Engineering Office</b>	
		Shack/S-Grush	Dec 16, 2002

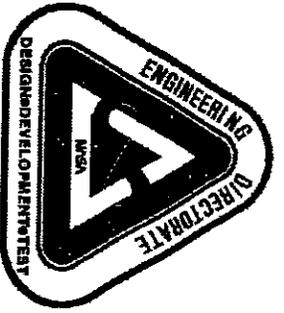
• **EA STS-107 pre-FRR Topics Summary (continued):**

• **EP – Propulsion and Power (cont'd)**

• OV-103 17" LO2 Feedline BSTRA Ball Cracks (cont'd)

- Seven teams initiated by MV/USA/Boeing to work issue (similar structure as was used for flowliner issue):
  - o Qualification and Test Team
  - o Inspection History and Inspection Plan Team
  - o M&P Team
  - o Test Team
- Chief Engineers Team initiated to provide additional checks/balance/oversight
- Fault Tree in work by MPS PRT.
- Boroscope inspections of 104 and 105 are in work/planned. Constraint to 104 engine install (as 12/11/02).
- OV-102 BSTRA inspections were completed with no anomalies found during last OMDP (prior to flight 27) – relook at video is in work.
- MPTA 17" lines (LO2/LH2) under inspection at JSC-ESTA.
- Tri-weekly status meetings have been set up with MV
- Rationale for flight may hinge on testing to bound the failure and demonstrate "use-as-is" capability (access for possible repair is highly limited)
- ES and EG also supporting problem resolution activities.
- Resolution for Flight: TBD

continued



<b>Engineering Directorate</b>		<b>Shuttle Engineering Office</b>
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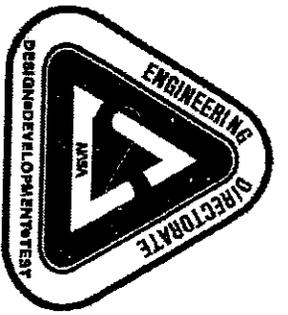
• **EA STS-107 pre-FRRR Topics Summary (continued):**

• **EP – Propulsion and Power (cont'd)**

• STS-113 Right OMS Engine Bi-Propellant Valve 2 Indicated Open (IFA: STS-113-V-02)

- At the end of the OMS assist burn (ascent), the right OMS ball valve 2 continued to indicate open.
  - The indication dropped only 0.5% so that the current reading is 95.8% and should be 0%.
  - Per the flight rules, the right OMS may be used for deorbit only.
  - The remaining on-orbit OMS burns were performed single engine using the left OMS.
  - The ball valve 2 gave a constant reading of 95.1% before, during, and immediately after the de-orbit burn (it did eventually increase to 95.8 during entry).
- At KSC the troubleshooting will verify valve position during ball valve drain scheduled for Dec. 14, 2002. If necessary, the LVDT (most probable cause) will be replaced by the vendor.
  - LVDT failures have been observed before.
- Rationale for STS-107: Redundancy and successful ground checkout

continued

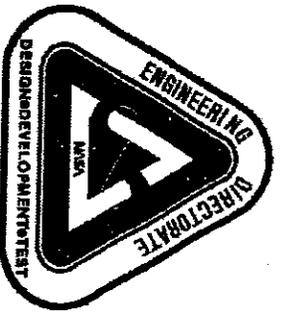


<b>Engineering Directorate</b> <b>STS-107 Quick Look</b> <b>Summary</b>		<b>Shuttle Engineering Office</b>	
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• **EA STS-107 pre-FRR Topics Summary (continued):**

- **EP – Propulsion and Power (PSIG MPS Integration)**
  - Flight specific prediction of ET GO2 pressurization performance indicates upper and lower ullage pressure ICD violations
    - STS-107 is first flight of Lightweight ET with Block II SSMs, ET LO2 100.15% loading sensor LCC, and moving average SRB burn-rate predictions (approved 11-04-02 ICB SR1756)
    - Lockheed Stress reported acceptable structural margins of safety with the predicted violations to the 12-02-02 Loads Panel
    - ICD waiver S061917 / IRN IO-1936 scheduled for 12-10-02 ICB approval
  - Lockheed review of ET relief valve qualification test data indicates run-to-run variation in cracking pressure is 1.5 psi greater than previously accounted for
    - Elevated GH2 prepress for Block II SSMs was designed for essentially zero margin to ET relief valve minimum cracking pressure
    - Will probably require adjustment to GH2 prepress control band set-points for STS-107 and subsequent launches (requires LCC and File II OMRSD changes) – to be finalized at the 12-13-02 PSIG telecon

continued



## Engineering Directorate STS-107 Quick Look Summary

Shuttle Engineering Office

Shack/S-Grush

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### • EA STS-107 pre-FRRR Topics Summary (continued):

#### • EP – Propulsion and Power (SSEIG)

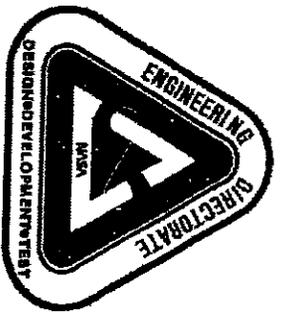
##### • Day-of-Launch I-Load Update (DOLLU II) Operations Support System (DOSS)

- Background: DOSS updates guidance polynomials and max-Q throttle bucket profile based on measured winds data in order to re-center the trajectory within flight design constraints
  - MOD personnel in the MER are the prime operators for this activity
  - Independent assessment by Boeing
- DOSS Block Update 2003.01 for STS-107
  - Boeing DOSS support facility moved from Huntington Beach to Houston – approved 11-19-02 ICB S052550MU.
  - Automated Meteorological Profiling System (AMPS) Phase 2: AMPS Low Resolution Flight Element (LRFE) balloons using GPS tracking replace current radar-tracked Rawinsonde balloons to acquire thermodynamic data and low resolution wind profiles for MSFC, SMG, and JSC Entry analysis – approved 11-07-02 PRCB S052550MT.

#### • EG – Aerodynamics; Aero/Thermal; GNC

##### • Entry Aerothermo and GN&C Flight Control Impacts due to Body Flap corrosion issue

- The GNC Technical Panel and Entry Aerothermo group will provide results on assessment to entry flight control impacts for different Body Flap settings in the event of a Body Flap actuator jam/failure.
- Reference previous EP summary - **OPEN ISSUE / FLIGHT CONSTRAINT**



## Engineering Directorate STS-107 Quick Look Summary

Shuttle Engineering Office

Shack/S-Grush

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### • EA STS-107 pre-FRRR Topics Summary (continued):

#### • ES – Transitioned-Orbiter: Structures / M&P; Non-Transitioned-Orbiter: TCS

##### • Crew Cabin Taped Pre-Routed Cables

- Numerous components taped to walls and panels do not meet and comply with Shuttle requirements (NSTS-07700, ICD-2-19001) to assess for emergency landing loads.
- Similar situation as in STS-113, which was assessed by ES and Boeing-Stress for STS-113. Was an attempt to be conservative, but ES does not consider it a generic assessment for STS-107 or subsequent due to remaining significant uncertainty in tape peel retention property on actual Orbiter surfaces.
- Tape pull test option in work for another unique assessment for STS-107 if time permits for allowing adequate test scatter for material and surface condition variability. Other options are re-visit analysis conservatism. **OPEN WORK, but NO FLIGHT CONSTRAINT.**

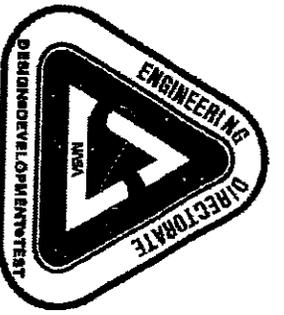
##### • SRB Forward Separation Motors' Large (> micron size) Aluminum Oxide Particles Ejecta

- Orbiter windows are not certified for these potential impacts. Unknown, unquantified damage or hazard potential.
- USA is preparing a test program plan for MV consideration. Similar effort as for the ejected RTV contaminant debris versus window impacts, but RTV tests do not apply. **NO FLIGHT CONSTRAINT.**

##### • Flow Liner Weld Repair

- Residual stress concerns associated with unique CRES material resolved by additional test results at NASA MSFC M&P and Boeing-Stress and ES acceptance thereof. **NO FLIGHT CONSTRAINT.**

continued

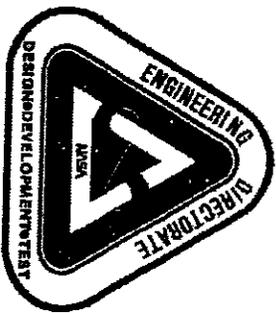


<b>Engineering Directorate STS-107 Quick Look Summary</b>		<b>Shuttle Engineering Office</b>	
		Shack/S-Grush	Dec 16, 2002

• **EA STS-107 pre-FRR Topics Summary (continued):**

- **ES – Transitioned-Orbiter: Structures / M&P; Non-Transitioned-Orbiter: TCS (cont'd)**
  - Body Flap (BF) Actuator Corrosion (discovered on OV-104)
    - Applicability to OV-102 remains TBD. If jamming potential exists and cannot be ruled out by inspection, valid rationale, and/or positive structural margins, then concerns exist for flight control issues and increased aero-thermal heating to the BF, elevons, their seals, and underlying and proximate structure.
    - ES is coordinated to EG's GNC group and Aero-Thermal Panel to assess jammed BF and implications.
    - ES and Boeing are reviewing Hamilton Standard stress analysis. Possible additional stress needed to assess load re-distribution for partial jam cases.
    - Reference previous EP summary - **OPEN ISSUE / FLIGHT CONSTRAINT**
  - OV-103 17" LO2 Feedline BSTRRA Ball Cracks
    - ES is supporting the various teams: Loads & Stress, M&P, Test
    - Reference previous EP summary - **OPEN ISSUE / FLIGHT CONSTRAINT**

continued



## Engineering Directorate STS-107 Quick Look Summary

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Shack/S-Grush

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### • EA STS-107 pre-FRR Topics Summary (continued):

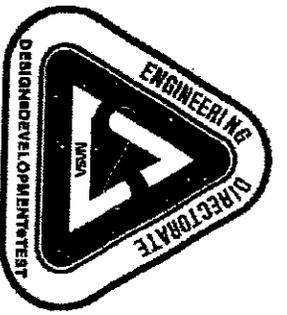
#### • ES - Systems Integration, Technical Panel Support, Shuttle Loads & Dynamics Panel

##### • Flight Margins Assessment

- Flight specific mass/stiffness properties of Shuttle mated vehicle coupled to cargo elements
- Several lift-off load screening indicator exceedances calculated on Orbiter and other Elements, but all were cleared by subsequent structural analysis demonstrating positive margins.
- **NO FLIGHT CONSTRAINTS.**

##### • Structures Working Group and On-Orbit Proximity Operations & Plume Impingement Joint Working Group:

- No issues



## Engineering Directorate STS-107 Quick Look Summary

Shuttle Engineering Office

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### • EA STS-107 pre-FRR Topics Summary (continued):

- EV – Avionics CFE / GFE / Software
  - No CFE topics
  - GFE - ET Sep Cameras
    - One of the two ET Sep cameras for STS-107 have not passed acceptance leak test – no obvious leaks have been found during troubleshooting to date.
    - Cameras from STS-113 were received the week of Dec 9<sup>th</sup>, and one is being readied for test along with rework of the failed camera. Intent:: utilize of of these two cameras for STS-107.
    - Need date at KSC: Week of Jan 6<sup>th</sup> for pad install. If unsuccessful, will fly without camera (done before).
    - The 35 mm ET TPS camera and one ET Sep camera have already been shipped and installed on OV-102/STS-107.
- Fifth Flight of OI-29 Software
  - No software changes post-STS-113 and no open issues at this time.



<b>Engineering Directorate STS-107 Quick Look Summary</b>		<b>Shuttle Engineering Office</b>	
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• **EA STS-107 pre-FRR Topics Summary (continued):**

• **EB – Bio-Medical Systems**

- PGSC (laptops):
  - Standard PGSC units for STS-107 – no new hardware
  - Externally-mounted micro-WIS components
    - 12 Micro-Strain Gauge Units (SGU's) installed in aft compartment
    - Flight battery installation and programming for flight planned to occur one week prior to launch

• **ER – RMS/SVS**

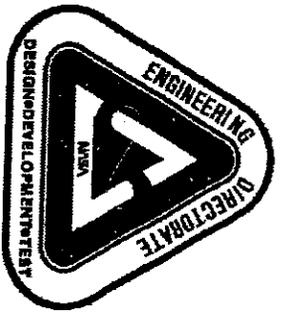
- No RMS or SVS flying on STS-107



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<b>Engineering Directorate</b> <b>STS-107 Quick Look</b> <b>Summary</b>		<b>Shuttle Engineering Office</b>	
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# **STS-107 BACK-UP INFORMATION**



**Engineering Directorate  
STS-107 Quick Look  
Summary**

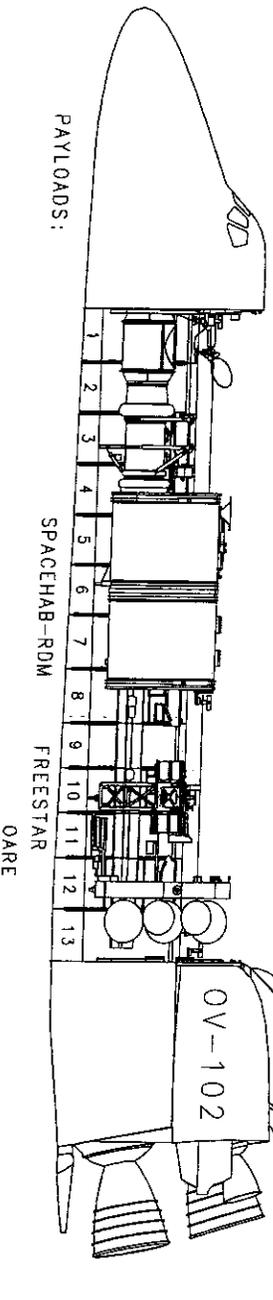
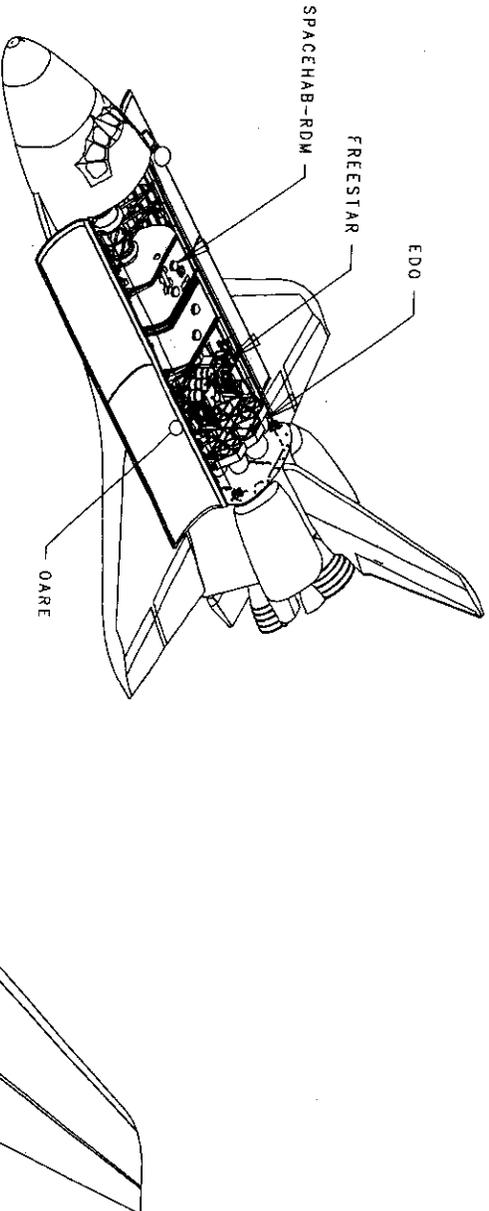
Johnson Space Center - Houston, Texas

Shuttle Engineering Office

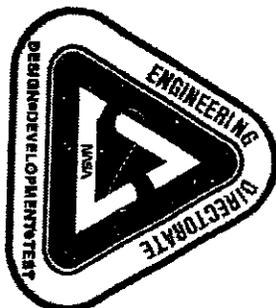
Shack/S-Grush

Dec 16, 2002

# Cargo Arrangement



SIS-107



# Engineering Directorate STS-107 Quick Look Summary

Shuttle Engineering Office  
Shack/S-Grush  
Dec 16, 2002

Johnson Space Center - Houston, Texas

## Flight Overview (provided by Boeing/USA Integration)

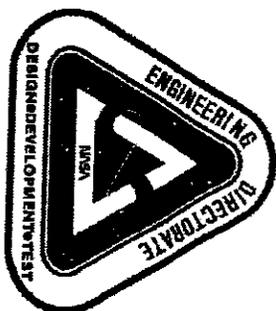
<b>Orbiter</b>	OV-102 (FLT 28)	<b>Cryo Tank Sets</b>	9 ( Offloaded )
<b>ET</b>	ET-93 (LWT)	<b>RMS</b>	Not Installed
<b>SRB</b>	BI-116	<b>Misc. Equipment</b>	EDO Pal/5 N2 Tks
<b>SSME</b>	2055, 2053, 2049 (All Block II SSMEs)	<b>OMS Load</b>	20,500 ( 81 % )
<b>Throttle Profile</b>	100/104.5/72/104.5	<b>FWD RCS Load</b>	2,175 ( 89 % )
<b>Software</b>	O1-29 (FLT 5)	<b>AFT RCS Load</b>	4,970 ( 100 % )

LAUNCH / ASCENT	ORBIT	NEOM LANDING
<b>Date</b>	Jan-16-03	Feb-01-03
<b>Time **</b>	10:39 EST 15:39 GMT ( Daylight )	08:49 EST 15 / 22 : 10 : 00 MET ( Daylight )
<b>Window</b>	150 mins 39 deg.	<b>Crossrange</b> 133 nm ( 838 max )
<b>Inclination</b>	Direct	<b>Node</b> Descending
<b>Insertion</b>	Direct	<b>Turn</b> Right
<b>PAD / MLP</b>	39A / 1	<b>Runway</b> KSC 15
<b>TAL Sites</b>	MRN ( ZZA )	

PAYLOADS	CREW
<b>Deploy</b>	<b>Schedule</b>
<b>Retrieve</b>	Commander
<b>Non-Deploy</b>	Pilot
Spacehab-RDM; OARE; FREESTAR	Payload Commander
	Mission Specialist
<b>Crew Module</b>	Payload Specialist
SIMPLEX; RAMBO	
<b>Payload Wt Up/Down</b>	
24,316 lbs* / 24,536 lbs*	

\* Source document: TDDP: FRRBF107(011)





Johnson Space Center - Houston, Texas

Engineering Directorate		Shuttle Engineering Office	
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## Digital Launch Window

November 11, 2002

Tam Nguyen/USH-489L  
Cindy Johnson/USH-489L

**STS-107 FRR DIGITAL LAUNCH WINDOW**  
NOMINAL FLIGHT DURATION = 15:22:10 (D:H:M) MET

DATE at Greenwich (MDY)	WINDOW OPENINGS				WINDOW CLOSINGS			
	1 KSC Sunrise SR-0 min GMT (H:M)	2 EOM+2/KSC 1-1-1 KSC&EDV SR-10 min GMT (H:M)	3 EOM+2/KSC SUNRISE SURPRISE SR+80 min GMT (H:M)	4 EOM+2/KSC 2-2-2 KSC&EDV SR-10 min GMT (H:M)	5 TAUZZA SS+15 min GMT (H:M)	6 TAUMRN SS+15 min GMT (H:M)	7 2.5 HOUR CREW ON-BACK GMT (H:M)	8 KSC Sunset SS+0 min GMT (H:M)
01/09/2003	12:17	14:09	15:19	15:43	18:28	16:59	18:13	22:42
01/10/2003	12:17	14:09	15:19	15:43	18:29	17:00	18:13	22:43
01/11/2003	12:17	14:08	15:18	15:43	18:30	17:00	18:13	22:44
01/12/2003	12:17	14:08	15:18	15:42	18:31	17:01	18:12	22:45
01/13/2003	12:17	14:07	15:17	15:42	18:32	17:02	18:12	22:45
01/14/2003	12:17	14:07	15:17	15:41	18:33	17:03	18:11	22:46
01/15/2003	12:17	14:06	15:16	15:41	18:34	17:04	18:11	22:47
01/16/2003	12:17	14:06	15:16	15:40	18:35	17:05	18:10	22:48
01/17/2003	12:17	14:05	15:15	15:39	18:36	17:06	18:09	22:48
01/18/2003	12:17	14:05	15:15	15:39	18:38	17:07	18:09	22:48
01/19/2003	12:16	14:04	15:14	15:38	18:39	17:08	18:08	22:50
01/20/2003	12:16	14:03	15:13	15:38	18:40	17:09	18:08	22:50
01/21/2003	12:16	14:03	15:13	15:37	18:41	17:11	18:07	22:51
01/22/2003	12:16	14:02	15:12	15:36	18:42	17:12	18:06	22:52
01/23/2003	12:15	14:01	15:11	15:36	18:44	17:13	18:06	22:53
01/24/2003	12:15	14:00	15:10	15:35	18:45	17:14	18:05	22:54
01/25/2003	12:15	13:59	15:09	15:34	18:46	17:15	18:04	22:55
01/26/2003	12:14	13:58	15:08	15:33	18:47	17:18	18:03	22:56
				15:33	18:49	17:17	18:03	22:57

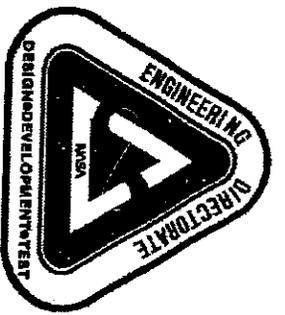
The nominal launch window open and close times are shown in boxes.  
Launch window duration is 2.5 hours

- 1 and 8 protect daylight launch
- 2 protects at least one daylight landing opportunity to KSC and EDW for EOM, EOM+1, and EOM+2
- 3 protects at least one daylight landing opportunity to KSC while at least 60 minutes after sunrise for EOM, EOM+1, and EOM+2
- 4 protects at least two daylight landing opportunities to KSC and EDW for EOM, EOM+1, and EOM+2
- 5 and 6 protect daylight TAU
- 7 protects 2.5 hour crew-on-back constraint



Launch/Landing Times not to be released to General Public until 24 hours prior to planned event





# Engineering Directorate STS-107 Quick Look Summary

Johnson Space Center - Houston, Texas

Shuttle Engineering Office

Shack/S-Grush

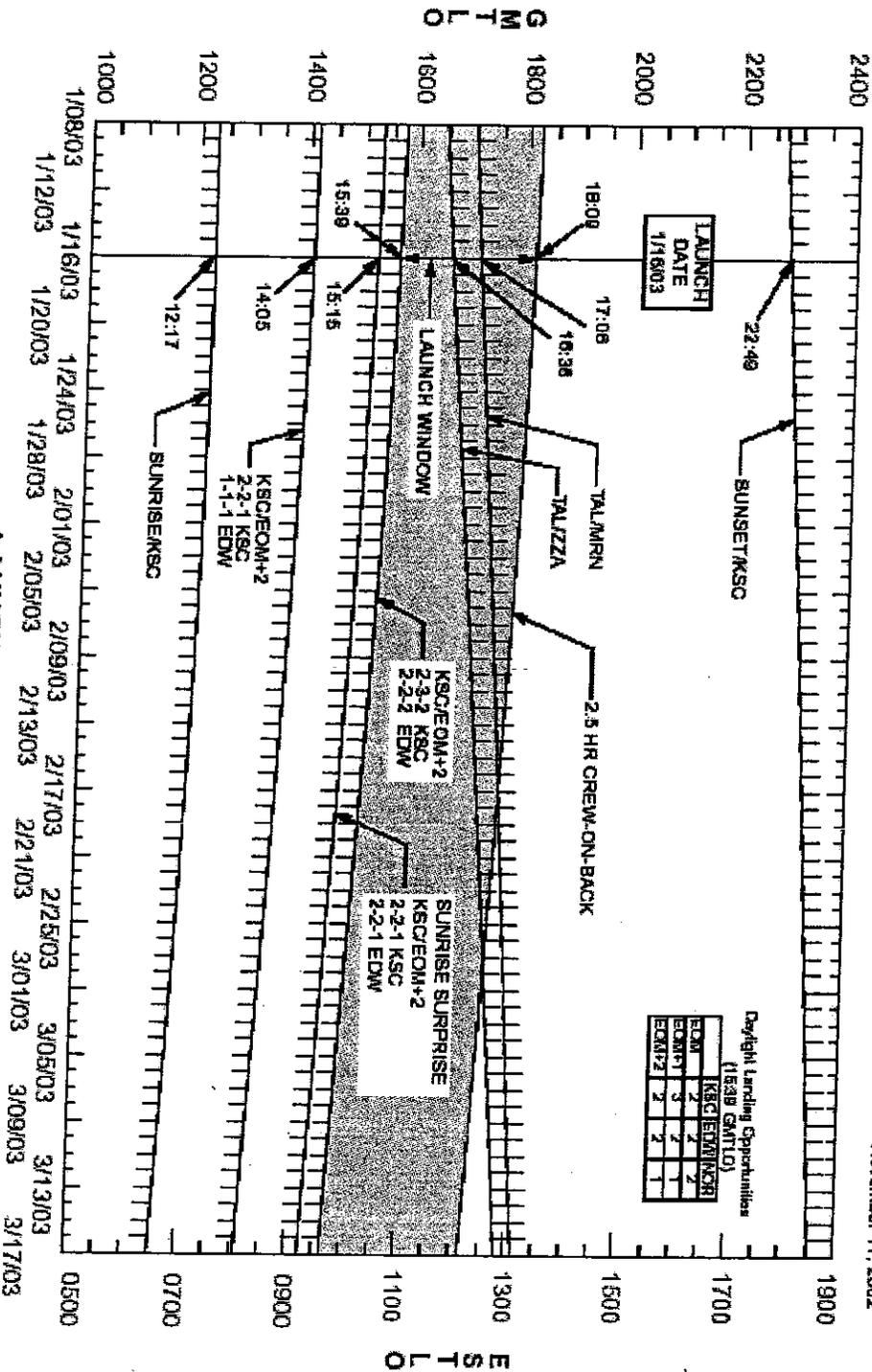
Dec 16, 2002

## Launch Window

Mission Duration = 16 + 2  
Inclination = 39.0°  
OMS2 height = 153 x 146 nmi

STS-107 FRR  
LAUNCH WINDOW

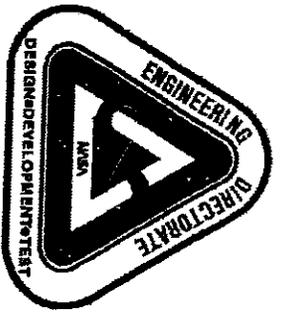
Tam Nguyen/LSH-483L  
Chry Johnson/LSH-483L  
November 11, 2002



Boeing Landing Times not to be released to General Public

24 hours prior to planned event





**Engineering Directorate  
STS-107 Quick Look  
Summary**

Johnson Space Center - Houston, Texas

Shuttle Engineering Office

Shack/S-Grush

Dec 16, 2002

Place Payload Safety charts  
here

## **Michele Lewis**

**From:** ROCHA, ALAN R. (RODNEY) (JSC-ES2) (NASA)  
**Sent:** Monday, December 16, 2002 4:32 PM  
**To:** RUPPERT, JOHN P. (JSC-EG) (NASA); DERRY, STEPHEN M. (STEVE) (JSC-EG3) (NASA);  
HAMMERSCHMIDT, MARK M. (JSC-EG4) (NASA); KRAMER, JULIE A. (JSC-EA4) (NASA);  
KOWAL, T. J. (JOHN) (JSC-ES3) (NASA)  
**Cc:** LEVY, VINCENT M. (JSC-EG) (NASA); 'Dunham, Michael J'; 'Alison.Dinsel-1@ksc.nasa.gov';  
'Madera, Pamela L'  
**Subject:** FW: PRT on Body Flap Actuator Corrosion

**Follow Up Flag:** Follow up  
**Due By:** Monday, December 16, 2002 7:00 PM  
**Flag Status:** Flagged

Can you all call-in and participate too? The agenda is "geared" toward the jam question.

Julie, I think you also want a 10:30 am CST discussion too, right? The basic issue for OV-102 is, does a jam scenario apply to OV-102 (STS-107) and, if so or cannot be ruled out, does the Shuttle Program want to consider special assessments (aero-thermal and flight control/stability) for STS-107? We have not been directed to do so (yet).

Rodney Rocha  
Structural Engineering Division (ES-SED)  
\* ES Div. Chief Engineer (Space Shuttle DCE)  
\* Chair, Space Shuttle Loads & Dynamics Panel  
Mail Code ES2 Phone 281-483-8889

-----Original Message-----

**From:** Salvador, Lincoln J. [mailto:LJSalvad@xch-bsco-06.ksc.nasa.gov]  
**Sent:** Monday, December 16, 2002 3:08 PM  
**To:** Salvador, Lincoln J.; EXT-Dahlke, Alan G; DAKE, JANNA J. (JSC-DF52) (NASA); EXT-Alvar, Wayne S; Rauch, Robert J.; BOLCH, LIONEL D. (DEVAN) (JSC-DF52) (USA); EXT-Brooks, Brian L; 'Carpenter, Susan HS-SNS'; EXT-Clancy, Anita M; Cabe, William L. (Butch); KRAMER, JULIE A. (JSC-EA4) (NASA); REGULA, KEVIN P. (JSC-CA) (USA); HERNANDEZ, FRANCISCO J. (JSC-EP) (NASA); GRUSH, GENE R. (JSC-EP111) (NASA); Goodmark, Jeffrey A; 'Grow, Al HS-SNS'; Heinol, Chip C; EXT-Heitzman, William J; EXT-Hoffman, Patty A; EXT-Cipolletti, John P; Kagawa, Richard A; 'Keenan, Bill HS-SNS'; EXT-Knight, Dennis M; 'Larson, Tara HS-SNS'; EXT-Snyder, Michael J; 'Parker, Janet'; 'RADEWAN, JILL HS-SNS'; 'Ross, Susan HS-SNS'; EXT-Hydorn, Terrie L; 'Tohlen, Dick HS-SNS'; 'Tollefson, Steve HS-SNS'; 'Valdez, Rudy HS-SNS'; 'Wahl, Brian HS-SNS'; 'Wells, Ken HS-SNS'; ROCHA, ALAN R. (RODNEY) (JSC-ES2) (NASA); EXT-Mosrie, Wan A; Dunham, Michael J; Burghardt, Michael J; Mulholland, John P; Southwell, Scott L.; Keyser, David S.; Fuller, Mike J.; Seraphine, Alan C.; Harrison, Steve; Rauch, Robert J.; Sheehan, Gerald; Merheb, Federico J.; McGurk, Brian; Park, Charles C; Diehl, James L.; Dye, Michael J; Moon, Darwin G; ZALIT, DANIEL P. (JSC-NC) (GHG); BASCI, TANSEL L. (JSC-NC) (SAIC); Ken Derleth (E-mail); Crawford, Johnny R.; McCorvey, Donald L; EXT-Hillier, Glen A; Damoff, Howard A.; Spalding, Richard M.; Wilson, Robert J.; 'Meesakul, Kathy'; 'Smith, Kevin'; 'Fekete, David'; 'Weiner, Debbie'; 'Gurecki, John'; LEVY, VINCENT M. (JSC-EG) (NASA); McDermott, Bill A; Pond, Charles L; EXT-Purkey, Vester; THIBODEAU, JOSEPH R. (JOE) (JSC-EG) (NASA); Lam, Loc T; SARAFIN, MICHAEL L. (JSC-DF6) (NASA); LEGA, DAVID B. (DAVE) (JSC-DF611) (USA); GRUBER, DAVID J. (JSC-DF611) (USA); GONZALEZ, RAMON S. (JSC-DF611) (USA); Herrera, Linda; Peck, Don; Moore, Randy J; EXT-Beckwith, Richard E; HAMMERSCHMIDT, MARK M. (JSC-EG4) (NASA); RUPPERT, JOHN P. (JSC-EG) (NASA); LEVY, VINCENT M. (JSC-EG) (NASA); ALBRIGHT, JOHN D. (JSC-EP4) (NASA); MAYEAUX, BRIAN M.

(JSC-ES4) (NASA); JACOBS, JEREMY B. (JSC-ES4) (NASA); EXT-Nurnberg, Gene R; EXT-Millang, Richard A; KENNEDY, JOHN J. (JSC-MV6) (NASA); ALLISON, RONALD L. (JSC-MV6) (NASA); EXT-Dinsel, Alison J #KSCEMS; EXT-Micklos, Ann M

Subject: PRT on Body Flap Actuator Corrosion

There will be a PRT on the Body Flap Actuator Corrosion on Tuesday (17Dec02) at 9:30 AM EST.

The action item list will be updated. If one has an action please attend or designate someone who can support with resolutions.

Two specific items that need discussion are:

1. What is the chance of spalling material off the internal gears? Can the spalling result in jamming the actuator?
2. Scenarios resulting from a jammed actuator.

AUDIO ACCESS INFORMATION:

=====

PRODUCT TYPE: UNATTENDED  
CALL TYPE: MEET ME

# OF LINES: Total=40 Dialout=0 Meet Me=40 Meet Me Toll=0  
Entry Method: Silent Entry  
CALL DATE: DEC-17-2002 (Tuesday)  
CALL TIME: 09:30 AM EASTERN TIME  
DURATION: 3 hr

LEADER: MR LINCOLN SALVADOR

FEATURES:

=====

Silent Entry

Link Salvador  
Boeing Sub-System Manager  
Mechanisms, Latches, MPM  
NSLD, Cape Canaveral, FL.  
321.799.6836 (voice)

## Michele Lewis

---

**From:** ROCHA, ALAN R. (RODNEY) (JSC-ES2) (NASA)  
**Sent:** Wednesday, December 11, 2002 12:12 PM  
**To:** LEVY, VINCENT M. (JSC-EG) (NASA); DERRY, STEPHEN M. (STEVE) (JSC-EG3) (NASA); RUPPERT, JOHN P. (JSC-EG) (NASA); HAMMERSCHMIDT, MARK M. (JSC-EG4) (NASA)  
**Subject:** FW: Jammed Actuator

FYI and, of course, we need to do the "homework" as Glenn Miller calls it.

### Rodney Rocha

Structural Engineering Division (ES-SED)

- ES Div. Chief Engineer (Space Shuttle DCE)
- Chair, Space Shuttle Loads & Dynamics Panel

Mail Code ES2 Phone 281-483-8889

-----Original Message-----

**From:** MILLER, GLENN J. (JSC-EA) (NASA)  
**Sent:** Wednesday, December 11, 2002 9:18 AM  
**To:** GRUSH, GENE R. (JSC-EP111) (NASA); ROCHA, ALAN R. (RODNEY) (JSC-ES2) (NASA)  
**Cc:** SHACK, PAUL E. (JSC-EA42) (NASA); KRAMER, JULIE A. (JSC-EA4) (NASA)  
**Subject:** Jammed Actuator

Gene and Rodney,

On this mornings tagup it sounded like the technical community was about to declare a jammed actuator as acceptable because it was not required by flight control. The statement about flight control not needing the body flap is probably true, however I would be surprised if the structures story was mature enough at this time to be "umbrella'ed" by a positive V&C assessment.

In particular, I would be interested in hearing how the external loads on the body flap are "redistributed" due to a jammed actuator changing the stiffness at one of the four attach locations. It maybe that the stiffness four each attach location is controlled more by the local structure (spars, ribs, ect) rather than the gearing in a mechanism. But I would think at least a quick FEM assessment and internal load ratioing would be in order to feel comfortable that the surrounding structure (including attach linkage) still has positive margins.

I don't think corrosion is a next flight concern, I'm more concerned about the precedence of saying that a jammed actuator is acceptable. This kind of a "universal" statement can come back to haunt you in the future if you don't do all the homework upfront.

Thanks Glenn

## Michele Lewis

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From: KOWAL, T. J. (JOHN) (JSC-ES3) (NASA)  
Sent: Tuesday, December 17, 2002 11:48 AM  
To: DERRY, STEPHEN M. (STEVE) (JSC-EG3) (NASA)  
Subject: FW: Body Flap trim analysis



body-flap-lock1  
.ppt

John Kowal  
ES3/Thermal Branch  
NASA-Johnson Space Center  
(281) 483-8871

-----Original Message-----

From: Carvajal, Olman [mailto:olman.carvajal@boeing.com]  
Sent: Tuesday, December 17, 2002 10:37 AM  
To: HAMMERSCHMIDT, MARK M. (JSC-EG4) (NASA)  
Cc: GOMEZ, REYNALDO J. (RAY) (JSC-EG3) (NASA); EXT-Madera, Pamela L;  
Norman, Ignacio; Chao, Dennis C; Coronado, Diana; Harder, James R;  
KOWAL, T. J. (JOHN) (JSC-ES3) (NASA)  
Subject: Body Flap trim analysis

ark,

The trim charts were updated to include a family of curves between the Thermal trim limit of 16.4 deg up elevon (7 deg down body flap) and the Aero trim limit of 12 deg down body flap, using the nominal Xcg - 2in. trim case (page 4).

This package will be presented at this afternoon's GN&C panel meeting (2pm, B.16, R111)  
Let me know if you have any questions.  
Olman.  
281-853-1561

> -----Original Message-----  
> From: Reddell, Brandon D  
> Sent: Monday, December 16, 2002 1:45 PM  
> To: Carvajal, Olman  
> Subject: clean version of 107 ppt package  
>  
> > <<body-flap-lock1.ppt>>

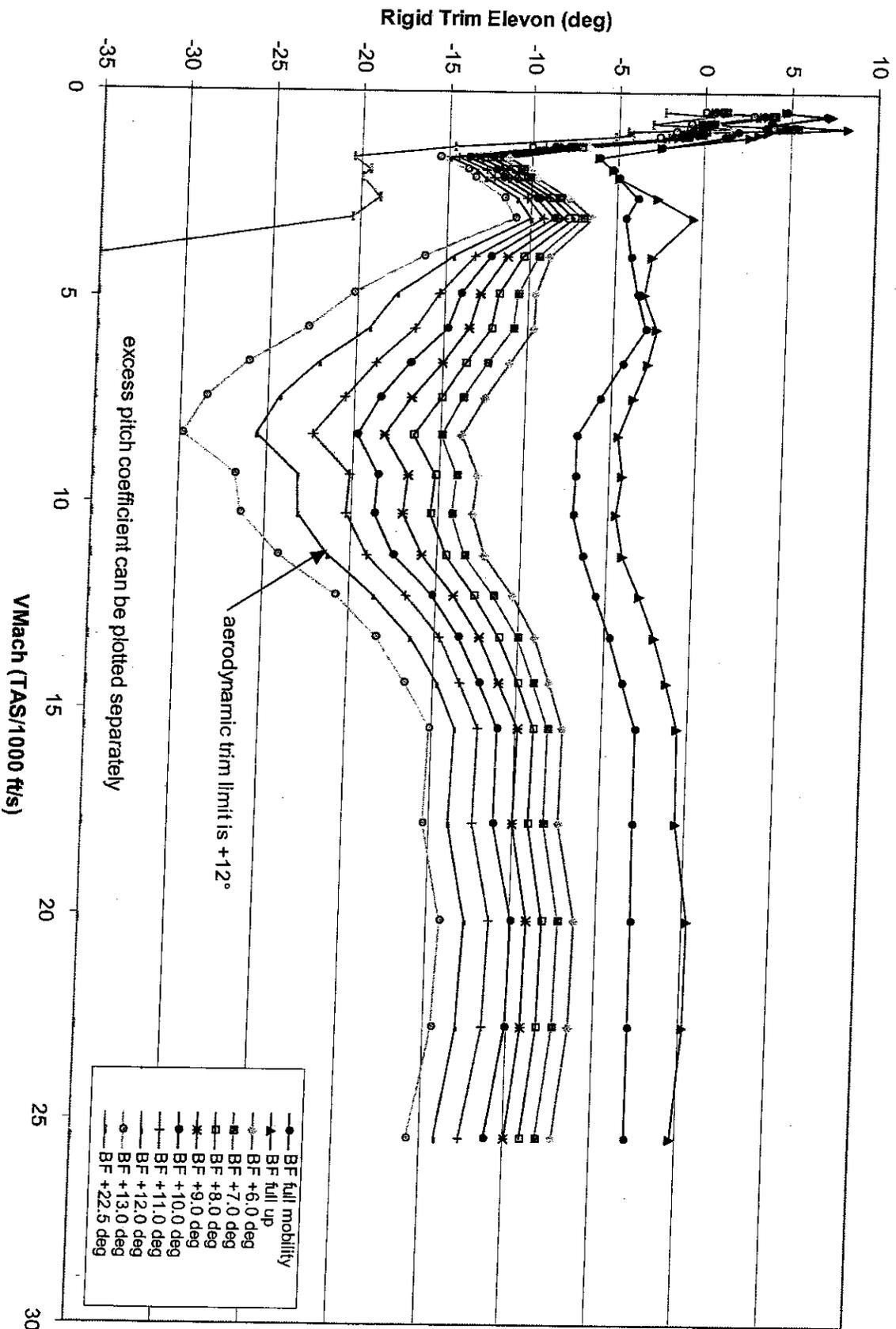
# STS-107 Entry Longitudinal Aerodynamic Trim Analyses with Body Flap Bounds

- Usual entry pre-flight longitudinal trim analyses performed using established flow process.
- Program “trim” modified to work with body flap locked at full up (-11.7°) or full down (+22.5°) position.
- Pre-flight longitudinal trim analyses performed for body flap at -11.7° and +22.5° using modified “trim” program.
  - Aerodynamic trim attempted with only elevons.
- Results presented on following 7 charts.
- Aerodynamics-only summary for longitudinal trim:
  - Trim possible with nominal and full-up body flap.
    - Elevon deflections within nominal operating bounds.
  - Trim impossible with full-down body flap.
    - Excess pitch might be controllable through RCS; however:
      - Elevons stay at -35° down to Mach 4 (heating issue).
      - Body flap hinge moment coefficients reach severe levels (structure issue).

3/19/2003

Georgi Ushev

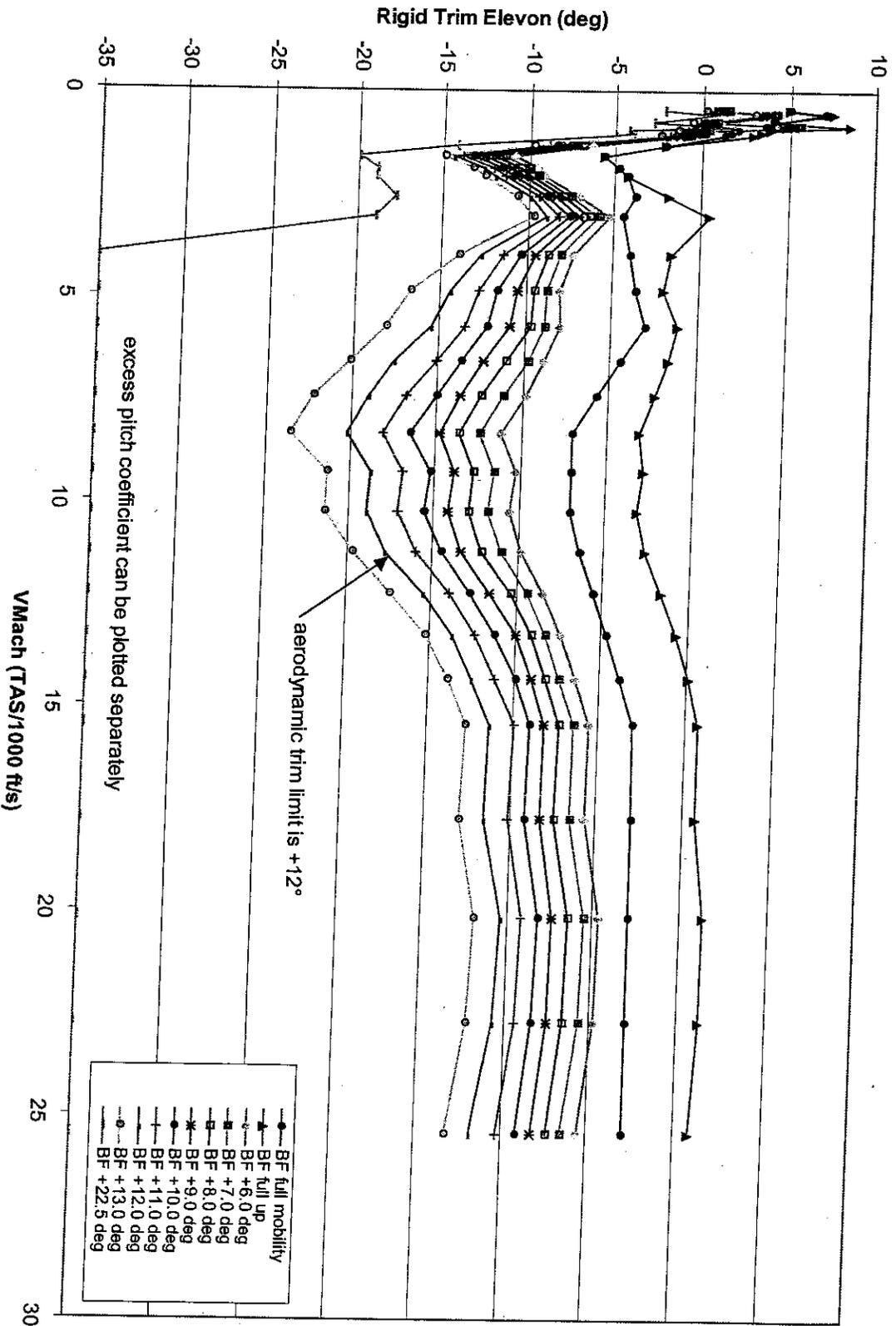
# STS-107 PRE-FLIGHT ENTRY LONGITUDINAL TRIM PREDICTIONS NOMINAL X-CG; NOMINAL SPEEDBRAKE



3/19/2003

Georgi Ushev

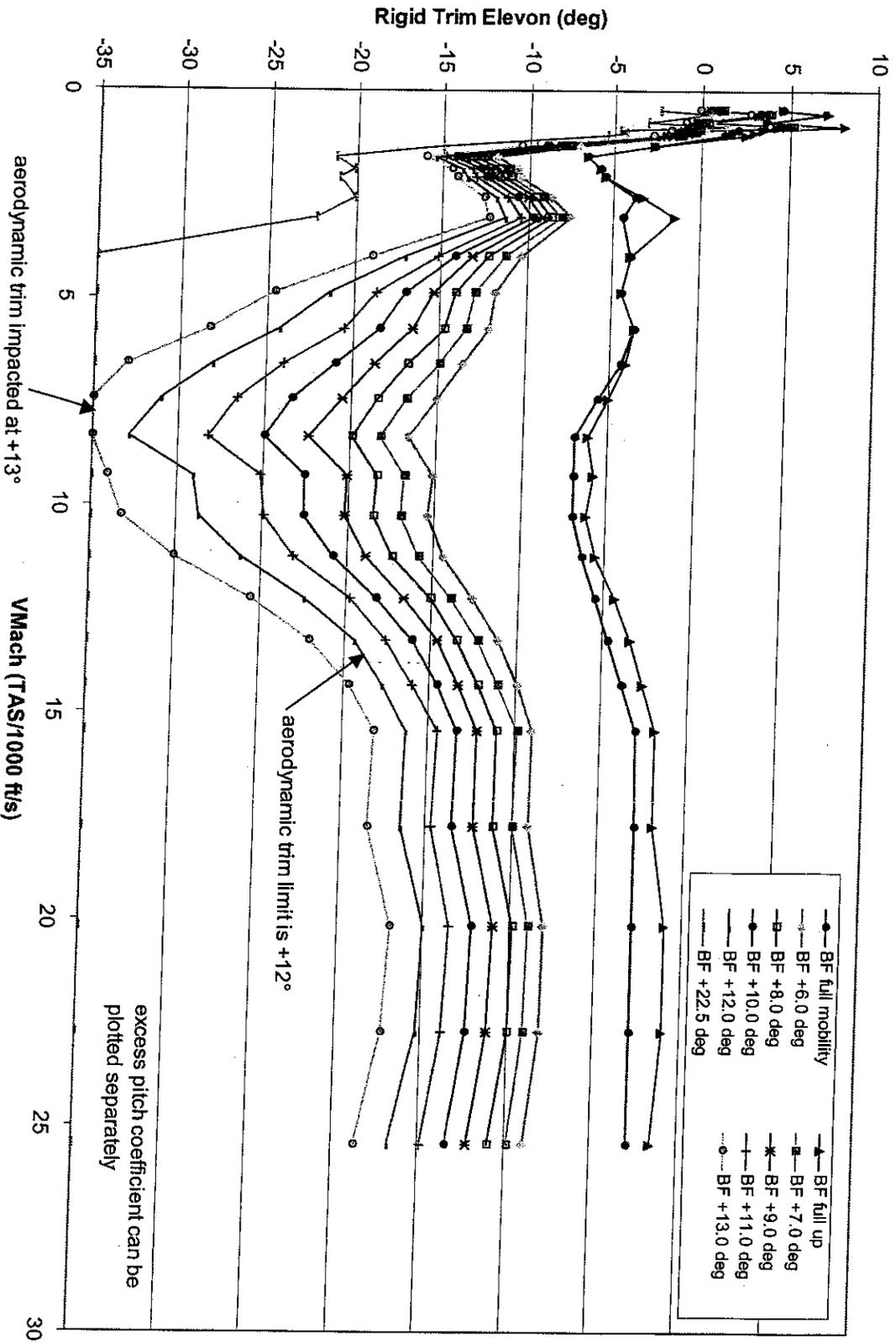
STS-107 PRE-FLIGHT ENTRY LONGITUDINAL TRIM PREDICTIONS  
 AFT X-CG (NOM + 2"); NOMINAL SPEEDBRAKE



3/19/2003

Georgi Ushev

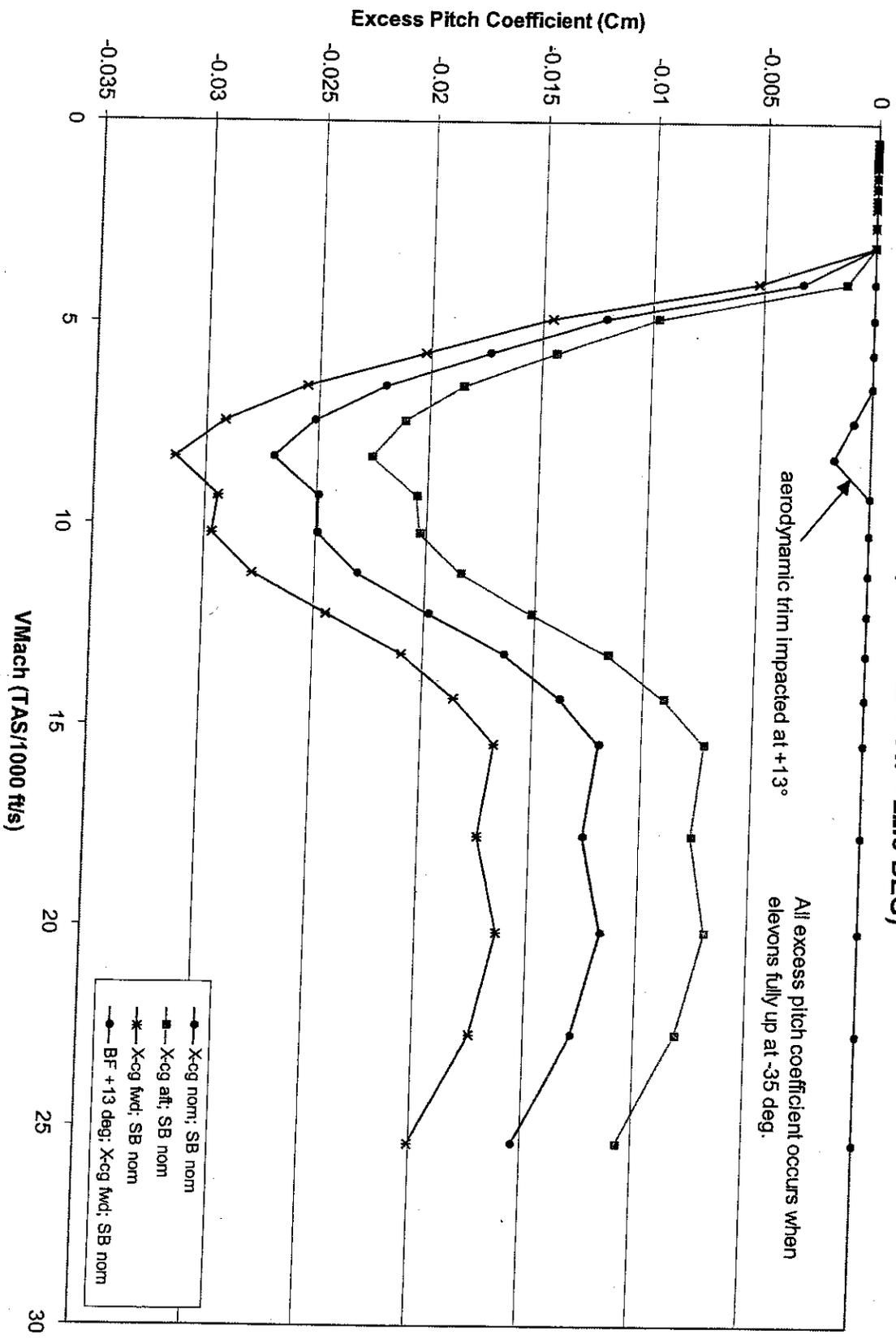
# STS-107 PRE-FLIGHT ENTRY LONGITUDINAL TRIM PREDICTIONS FWD X-CG (NOM - 2"); NOMINAL SPEEDBRAKE



3/19/2003

Georgi Ushev

**STS-107 PRE-FLIGHT ENTRY LONGITUDINAL TRIM PREDICTIONS  
EXCESS PITCH COEFFICIENT WHEN AERODYNAMIC TRIM IMPOSSIBLE  
(BODY FLAP AT +22.5 DEG)**

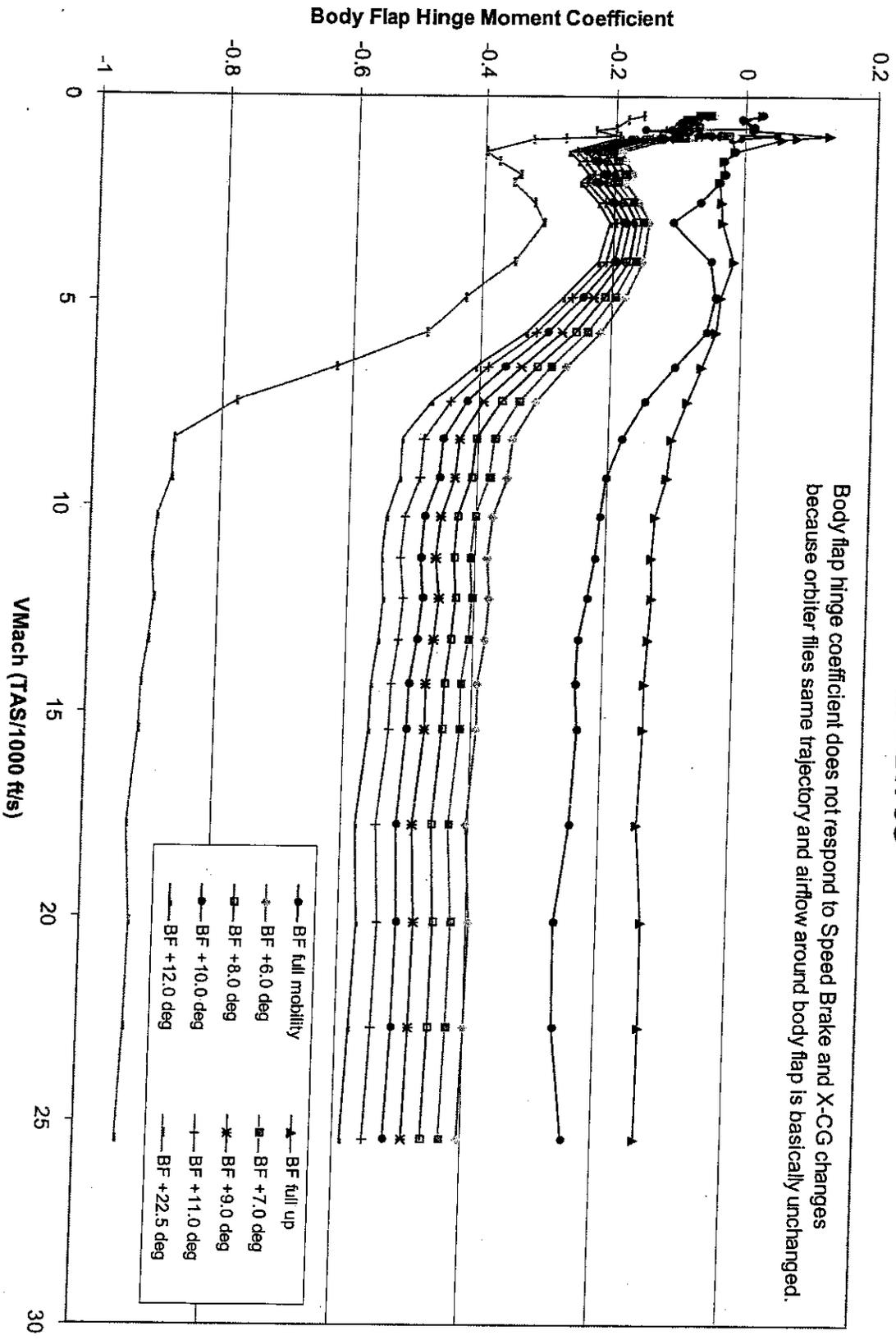


3/19/2003

Georgi Ushev

**STS-107 PREFLIGHT ENTRY LONGITUDINAL TRIM PREDICTIONS  
 BODY FLAP HINGE MOMENT COEFFICIENT  
 NOMINAL X-CG**

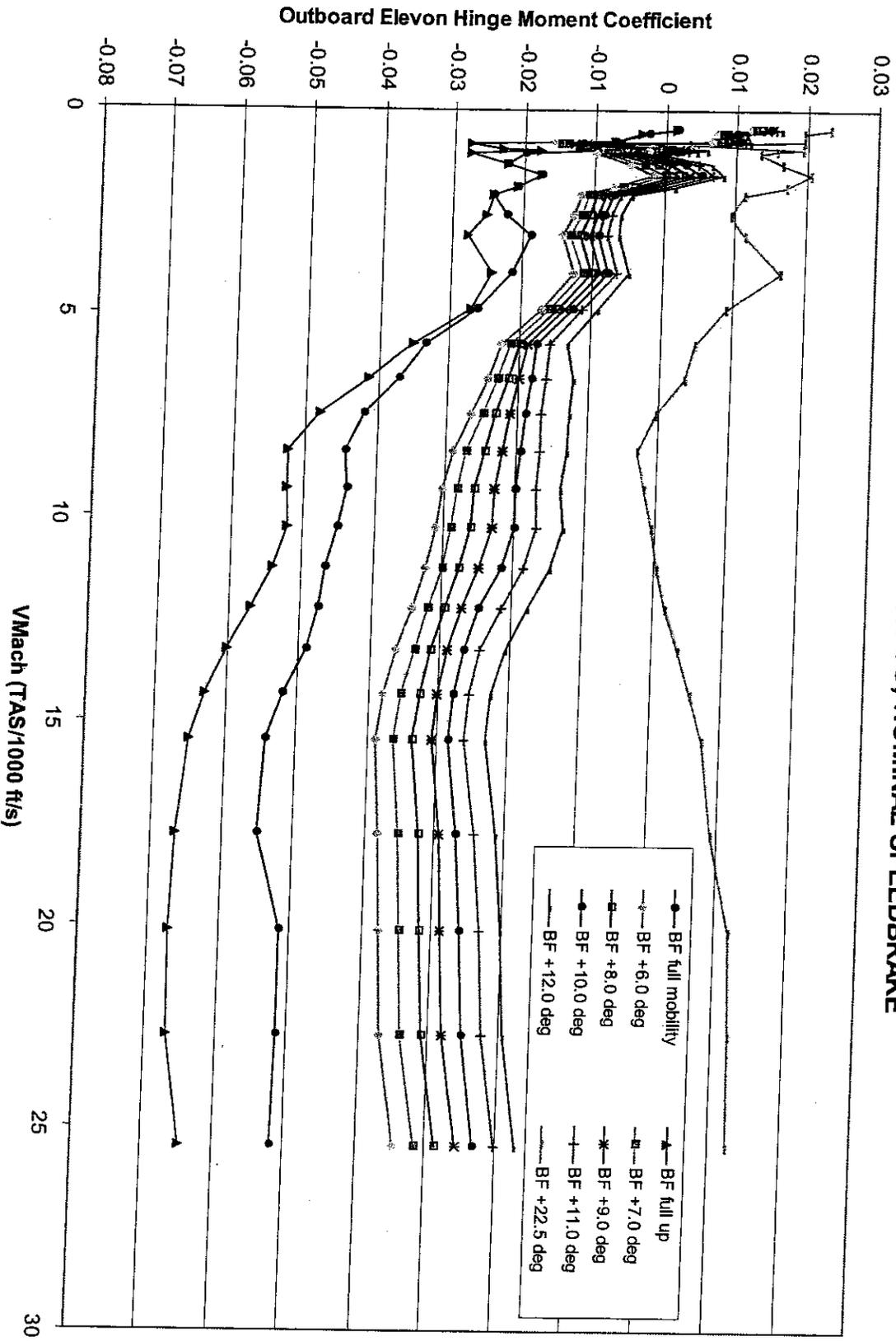
Body flap hinge coefficient does not respond to Speed Brake and X-CG changes because orbiter flies same trajectory and airflow around body flap is basically unchanged.



3/19/2003

Georgi Ushev

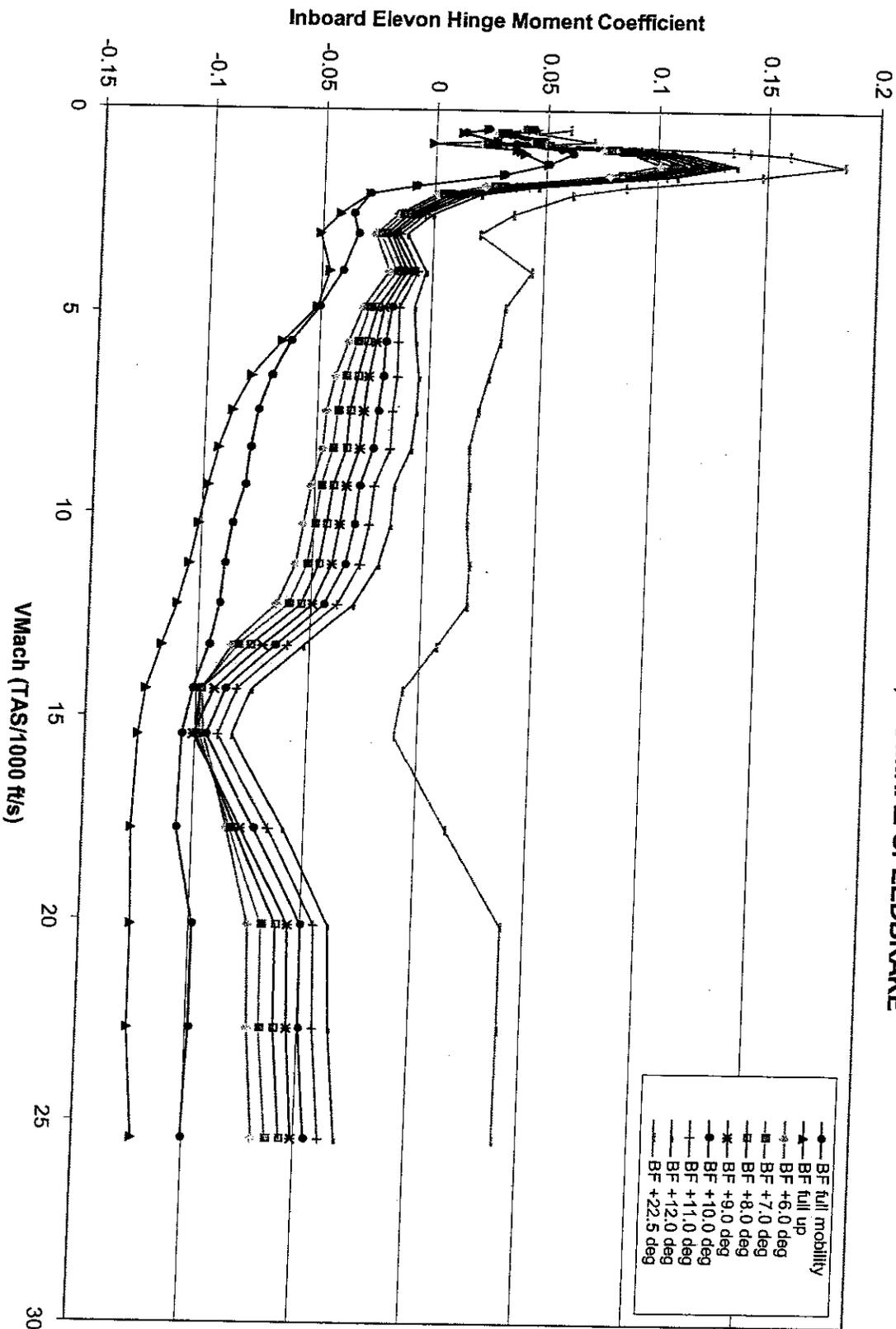
**STS-107 PRE-FLIGHT ENTRY LONGITUDINAL TRIM PREDICTIONS  
 OUTBOARD ELEVON HINGE MOMENT COEFFICIENT  
 NOMINAL X-CG; NOMINAL SPEEDBRAKE**



3/19/2003

Georgi Ushev

**STS-107 PRE-FLIGHT ENTRY LONGITUDINAL TRIM PREDICTIONS  
 INBOARD ELEVON HINGE MOMENT COEFFICIENT  
 NOMINAL X-CG; NOMINAL SPEEDBRAKE**



3/19/2003

Georgi Ushev

**Michele Lewis**

**From:**  
**Sent:**  
**To:**

Harder, James R [James.R.Harder@boeing.com]

Tuesday, December 17, 2002 10:04 AM

Asp, Alan; Blankinship, Kevin G; Bob Reitz (E-mail); Bret A Picka (E-mail); Brian Bihari (E-mail); Bui, Hiep M; Campbell, Darrell D; Carter, Justin H; Cason, Kyle W; Chan, Luen H; Chao, Dennis C; CHIPMAN, DEANNA L. (JSC-DT6) (BOE); Chris Hickey (E-mail); christopher.j.ferguson1@jsc.nasa.gov; christopher.tuason@lmco.com; Cohen, Sam D; Corbin, Douglas W; Dailey Peter (E-mail); Digon Ed (E-mail); ADAMS, RANDALL W. (JSC-MA2) (NASA); BECK, KELLY B. (JSC-DA8) (NASA); BRIEDEN, MICHAEL A. (MIKE) (JSC-MV) (NASA); CAIN, LEROY E. (JSC-DA8) (NASA); CARVAJAL, JAMES V. (JSC-ER2) (NASA); CECCACCI, ANTHONY J. (JSC-DA8) (NASA); EXT-Dannemiller, David P; DERRY, STEPHEN M. (STEVE) (JSC-EG3) (NASA); DOUGLAS, KATHERINE J. (JSC-EV) (NASA); DWYER, KENNETH J. (JSC-MV6) (NASA); ESS, ROBERT H. (BOB) (JSC-MS2) (NASA); FOSTER, ANDY (JSC-NC) (GHG); FRANK, MICHAEL L. (MIKE) (JSC-DT) (USA); EXT-Goodman, John L; GRAHAM, DAVID B. (JSC-DM2) (NASA); GRUBER, DAVID J. (JSC-DF611) (NASA); HALE, N. W., JR (WAYNE) (JSC-DA8) (NASA); HAMMERSCHMIDT, MARK M. (JSC-EG4) (NASA); HARPOLD, JON C. (JSC-DA) (NASA); HICKEY, ALYSON (JSC-CC5) (NASA); HOBAUGH, CHARLES O. (LTCOL) (JSC-CB) (NASA); EXT-Hutchins, John E; IVES, DALLAS G. (JSC-EG) (NASA); EXT-Jacobs, William A; EXT-Jones, Joseph H; JONES, RICHARD S. (JSC-DM) (NASA); KANIPE, DAVID B. (DAVE) (JSC-EG) (NASA); EXT-Kyle, David A; EXT-Lamotte, Nicole O; LAW, HOWARD G. (JSC-EG) (NASA); EXT-Lessmann, Christopher F; LEVY, VINCENT M. (JSC-EG) (NASA); LOWES, FLORA B. (JSC-DM) (NASA); EXT-Madera, Pamela L; MATTHEWS, DAVID S. (JSC-CB) (USA); MAY, DARRYL W. (JSC-MV2) (NASA); MCCOOL, WILLIAM C., CDR. (JSC-CB) (NASA); MONTEZ, MOISES N. (JSC-EG) (NASA); MOSES, MICHAEL P. (JSC-DF611) (NASA); MURRAY, SCOTT V. (JSC-EV) (NASA); NGUYEN, CUONG Q. (JSC-XA) (NASA); EXT-Olsen, Rosie; PARK, ALASTAIR (AL) (JSC-DT3) (USA); POGUE, GLENN E. (JSC-DM) (NASA); EXT-Reed, Milton W; EXT-Rogers, Sharon D; ROTHER, MELVIN R. (JSC-MV2) (NASA); RUPPERT, JOHN P. (JSC-EG) (NASA); SHANNON, JOHN P. (JSC-DA8) (NASA); SILVESTRI, RAYMOND T. (RAY) (JSC-DM4) (NASA); SIMPSON, SCOTT W. (JSC-NE) (SAIC); STERLING, MICHAEL R. (JSC-DT3) (USA); EXT-Strahan, Alan L; VEILE, MARK A. (JSC-DT3) (USA); EXT-Wilson, Philip T; WITWER, DAVE W. (JSC-NC) (SAIC); WOESTE, TIMOTHY (TIM) (JSC-EG) (NASA); Fiske, Bruce; Flecklin, Anton F; Gavert, Donald E; Hamilton, John S; Hirsch, Guy N; PENDERGAST, JAMES E. (JSC-NC) (GHG); GARDNER, JAMES R. (JSC-NC) (GHG); Jayne, Stephen D; Jeff Peters (E-mail); John Magley (E-mail); GOWAN, JOHN W. (JSC-DM) (NASA); Judith L Powell (E-mail); Kinder, Gerald R; ABADIE, MARC J. (JSC-DM44) (NASA); Matthews, Wayne A; McClain, Terrell A; Montag, Maria J; Nader, John M; Norman, Ignacio; Owen, Debra S; Patti A Thornton (E-mail); Phail, Brian A; Poladian, D; Price, Christopher E; Sean Vicary (E-mail); Sharon G Desch (E-mail); FRAZIER, STEPHEN E. (STEVE) (JSC-DM) (USA); Steve Munday (E-mail); Tanita, Thomas T; Tomooka, Roy; Ward, M A; Yang, Richard M

**Cc:** SMITH, JANE M. (JSC-EG) (NASA)

**Subject:** Charts for today's Entry GN&C



TAL Target Line TAL QBAR GC Panel  
Entry QBAR Ana.OPE EXPANSIONS Expansion -1:

Dec 17 at 2:00 CST in B16, Rm 111. A reminder that the Entry GN&C panel will meet today, Tues, The agenda with attached charts follows:

1. Status of Bodyflap Actuator Corrosion Analysis (all) (no charts)
2. TAL (OPS3) Qbar Envelope Expansion (Schottel/Reed)  
<TAL Target Line Entry QBAR Analysis.ppt>> <<TAL QBAR ENVELOPE EXPANSION.ppt>>
3. GRTLS Envelope Expansion Groundrules & Assumptions (Blankinship/Wilson)

<<GC Panel GRTLS Expansion -12-19-2002-JPEG.ppt>>

For those in Houston, limited hardcopies will be available at the meeting. All charts should be viewable electronically during the meetings well (overheads not required).

Thanks,

Jim Harder  
281-226-8541  
Entry GN&C/FC Analysis  
Boeing NASA Systems